ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

What in the World!

New Year's resolutions are in order. We have only one, and that is to make "Electrical World" bigger and better. We can do this for reports after a careful survey show that business will be better and the industry will be on the up-grade.

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But we are not going to accept a business up-turn as an end to industry problems. On the contrary, we hope to write more courageously than ever in an endeavor to be constructive and to get action that accords with the best thought available in the industry. As a consequence we expect some letters like the following: "In other words, the country is going to the dogs, for heaven's sake why don't you and the whole minority sell out?" But others may read as follows: "Keep up the good work, your thoughtful editorials and articles are a godsend to us in this time of trial."

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And we are still firmly convinced that private enterprise and initiative are in the public interest. And we don't like unfair competition of the type exhibited in the following vivid contribution: "Why travel all around Robin Hood's barn? It is reported that the Kansas City Power Light Company paid a federal income tax for 1932 of $600,000. The municipal electric system in Kansas City, Kan., has applied to the P.W.A. for $600,000 for underground construction. It would seem that the federal government would have greatly simplified the transaction if it had instructed Joseph Porter, president of the K.C.P. & L. Co., to write a check to the Kansas City, Kan., municipal system and send it across the Kaw River by messenger. Of course, the Kansas City, Mo., citizens are very happy indeed to be allowed to pay for an underground system for their friends across the river." We got the point and hope the public will eventually.

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DECEMBER 23, 1933

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Another Company Modernizes Breakers with OIL BLAST

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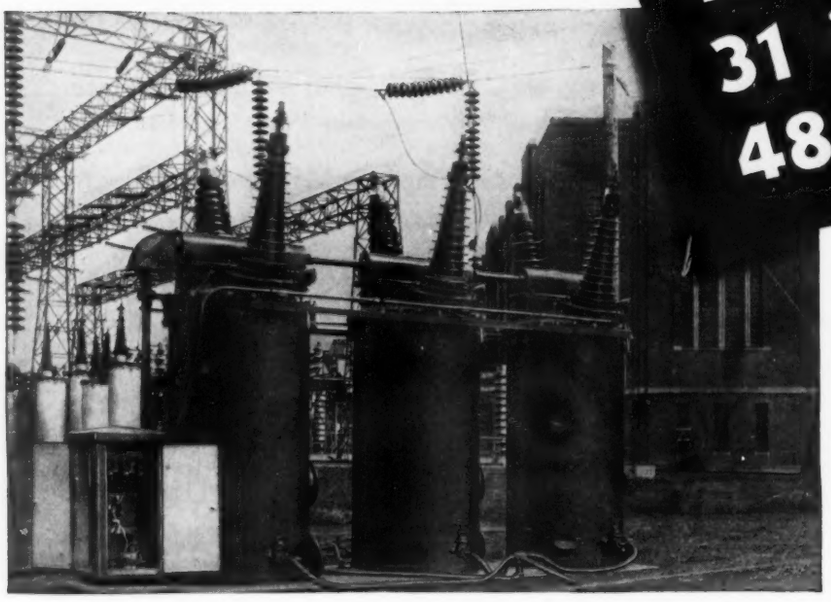

Type FHKO-139 breaker modernized with oil blast

NRA MEMBER U.S. WE DO OUR PART

Performance Counts. This is again evidenced by the fact that one of the large power companies has modernized an increasing number of breakers since 1931. During the last three years, 94 "FHK" outdoor-type G-E breakers, of various voltages, have been modernized and improved by the addition of oil blast.

The engineers of that company have found that oil blast assures better performance and higher speed of circuit interruption. Each year the success of these modernized breakers added further evidence of the effectiveness of oil blast.

You, too, can modernize your G-E breakers —quickly, easily, and economically. The addition of oil blast will result in greater interrupting ability; decreased maintenance; greater security; better service; and the rapid clearing of faults, which is one of the important factors in stabilizing a system.

Send for detailed information which will explain how you can modernize the G-E breakers on your system. General Electric, Schenectady, N. Y.

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GENERAL ELECTRIC

ELECTRICAL WORLD

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for the Week Ending

December 23, 1933

L. W. W. MORROW, *Editor*

The Census Tells the Story

CRITICS of the light and power industry will do well to study the 1932 U. S. Census. The government also might use these facts to arrive at two or three conclusions as to the public benefits supposed to come from its present subsidized competition program. Facts are very illuminating.

The fixed capital assets of the privately owned light and power industry are $14,370,420,592, the capitalization is $6,678,761,901 in long-term debt and $6,935,848,539 in stocks, a total of $13,616,610,440, and the reserves aggregate $1,381,566,874. Where is there an industry so large and so sanely balanced as to fixed capital, capitalization and reserves? Where are the figures to show watered stock and tremendous exploitation of the public?

The fixed capital of all the municipal utilities is $613,076,599, their long-term debt $208,975,676, their cash investment $250,319,737 and their reserves $91,947,532. These figures give a very positive idea of the relative national magnitude and importance of the private and municipal properties in this country, with especial emphasis upon the number and magnitude of stockholders and bondholders interested in the industry.

But let us go further. These combined utilities served a total of 23,858,411 customers in 1932 and sold them 65,895,975,835 kw.-hr. for $1,821,105,524. This is an average use per customer of 2,762 kw.-hr. and an average bill per customer of $77. Put in another way, the energy was sold at an average rate of 2.8 cents per kilowatt-hour. Each dollar of revenue required nearly eight dollars of fixed investment. Do these figures support many of the contentions of critics of the industry?

And what about the domestic business? There are 17,337,876 customers of private utilities alone who used 10,410,749,374 kw.-hr. and paid $584,995,286 for the service. This gives an average use per customer of 600 kw.-hr., an average bill per customer of $33.60 and an average rate per kw.-hr. of 5.6 cents. For less than an average of $3 per month the homes of America receive the benefits of electric service. And the unit rate for this energy is a function of the amount of electricity these customers will use. At present the rate is decreasing and the usage increasing just as fast as can be economically justified. Is this trend and is this rate so outrageous that the government should subsidize competing plants and thereby handicap instead of aid the accomplishment of an objective in the public interest?

Just as a yardstick, it is interesting to look at the municipal plants only. They have 1,947,684 domestic customers who used 1,379,390,137 kw.-hr., for which they paid $64,769,464. This is an average use per customer of 708 kw.-hr., an average bill per customer of $33.30 and an average rate per kilowatt-hour of 4.7 cents. Is this an odious comparison to make with light and power companies which serve many more rural and small-use apartment house customers in proportion to the total number of customers and

in general have a greater relative investment because of a predominance of underground systems and extended transmission lines?

The average price per kilowatt-hour for all energy sold by the privately owned utilities is 2.7 cents; of the municipal plants 3.1 cents. The private utilities serve 592,692 farm customers and charge them an average rate of 2.8 cents per kilowatt-hour. The municipal plants serve 21,061 farm customers and charge them an average rate of 5.6 cents per kilowatt-hour. The private utilities charge an average rate of 4.3 cents for small light and power service; the municipals 2.6 cents; classification differences explain part of this differential. For large power customers the private utility rate is 1.5 cents per kilowatt-hour and the municipal rate is 1.7 cents.

These census data are very significant. They show the contrasting service and cost conditions for large utilities serving widely extended geographical areas as contrasted with municipal utilities serving small but concentrated communities. These data, plus an understanding of the business, point to no discrediting facts for either private or municipal utilities. Both are doing the same work and both arrive at a balanced business position as a result of facing economic facts with the idea of developing and expanding their business. Above all, these data show that the private utility business as a whole is conservative yet progressive. It invests wisely and charges for its services in accord with investments and market conditions. There is no evidence of exploitation or of overcapitalization. There is every evidence of the necessity for public and investor concern to maintain the industry in a prosperous condition so that it may expand its service at a reasonable cost. Why, then, all the excitement and clamor? Why is it necessary to destroy the credit of the industry and the confidence of investors in the integrity of the industry? We commend this census to the citizens of this country.

Engineering needs national spokesmen

For years it has been a defect of the national engineering societies that they have been treated as a medium of telling technical things to the engineers. What the engineer had to tell the world for its good and his own found no adequate outlet. With popular recognition of the dominant part the engineers and technical experts have played in bringing the social and economic world to its present state of confusion, it has become imperative to find such a channel of mass education. Engineering leaders have increasingly responded to this need in their addresses before engineers and other groups. American Engineering Council has done yeoman service in advising government on projects, on appointments and on prospective legislation.

Engineers' Council for Professional Development is another and newer movement to integrate and overcome all the factors that now hold the engineering profession to a lower plane of recognition than its social significance deserves. Out of it will come keener encouragement and selection of apt engineering students, more uniform standards of attainment in engineering schools, more meaning to grades of society membership and a sound basis for registration of practicing engineers. Much as some of these moves grate upon the smugly intrenched engineer, they are an inevitable concomitant of a world that is moving fast into a reformed social structure. The next generation of engineers will be better engineers.

Apart from American Engineering Council and from Engineers' Council for Professional Development there is imperative need for a representative group of engineers, officially constituted, to tell a wondering world whether what is transpiring today is sound economic sense or merely the frantic stabs of a harassed combatant who cannot quite see his adversary. Engineering societies are expected by their 50,000 or more members to find a way quickly to constitute a joint non-propaganda body that will leave to the present units the long-range evolution of the profession and the immediate guidance at Washington. Its job will be to interpret the moves to reform our whole social structure and see wherein they go counter to methodical observance of economic-engineering principles that are well known to engineers, but not more than dimly grasped by even the most intelligent public. Too much of this is being done in unorganized fashion, ably in many instances, but unaccredited and lacking group support of all engineers.

THE WEEK

Federal Loans to T.V.A. Consumers Will Finance Appliance Sales

THROUGH an executive order, President Roosevelt this week directed the establishment of a Delaware corporation, the Electric Home and Farm Authority, Inc., with a capitalization of $1,000,000 to lend money to householders in the Tennessee Valley for the purchase of electrical energy-using devices. All the capital stock will be owned by the National Recovery Administration, making the activities of the new authority a direct governmental tie.

Manufacturers to co-operate

Rumors have long been flying of plans whereby several manufacturers of electrical equipment would co-operate with T.V.A. for the wide use of appliances in the valley by promising to sell such devices on a government-financed basis. Credit will be extended by the R.F.C. up to $10,000,000.

According to Stephen T. Early, assistant secretary to the President, the purpose of the whole plan is to extend "cheap credit" to all home owners and residents within the Tennessee Valley Authority area for the purchase of electrical appliances.

The project, Mr. Early said, is experimental, and if it proves successful "the next step will be to try to persuade private capital to accommodate purchasers so that the thing can be made nation-wide in scope.

"Manufacturers of electrical appliances," he added, "have been in Washington in conference with T.V.A. officials, and are most anxious to obtain the market, and have agreed to reduce materially the selling prices of most of their products."

In further explanation of the project, David Lilienthal, member of the Tennessee Valley Authority, stated:

"The objective of this program is a wider and greatly increased use of electricity in the homes and on the farms in the seven states of the Tennessee Valley. In order to carry out the program there must be a broad-scale distribution of very-low-cost-standard-quality electricity-using appliances, and concurrently a revision downward of electric rates. The new agency is based on a cooperative program in which the federal government, the electric utilities, both publicly and privately owned, the electric manufacturing industry and dealers will participate.

"Through the Electric Home and Farm Authority, it is proposed that the federal government participate in this program in the following way:

"1. By assisting in financing the consumer in purchasing standard electric equipment at very low prices.

"2. By securing reductions in electric rates; by agreement with the utilities, public and privately owned, so as to make use of this equipment feasible for the average householder and farmer.

"3. By engaging in educational work and research to further lower the cost of electric equipment and to make it better adapted to the needs of the average home and farm.

"Electric appliances are now sold by regular dealers for the manufacturers, by hardware and department stores and by electric utilities. The program does not contemplate a disruption of these outlets. Each dealer will, of course, continue to exhibit and sell any line of electric appliance he desires, but he will also have an opportunity to sell the low-priced appliances which this program is expected to create.

Aurora Dam to be next

Development of the Aurora Dam on the Tennessee River as a part of the plan for an integrated power program embracing the entire Tennessee River basin has been decided upon by the Tennessee Valley Authority. This decision has been forwarded to private interests which sought control of the Aurora Dam site. The Aurora project is located in Kentucky approximately 44 miles up stream from the confluence of the Tennessee and Ohio rivers.

"From an engineering standpoint Aurora Dam is being studied by the authority to determine whether it should not be one of its next projects," Chairman Arthur E. Morgan said. "The Tennessee Valley Authority, however, does not feel justified in starting another project with its present funds. We have only enough to finish one job and make a good start on Wheeler Dam.

"The value of a power dam is roughly the value of the least amount of power which that project can produce. For example, during the high-water season there would be little or no power at Aurora Dam because the Ohio river is so high that it backs up nearly to what would be the top of the dam. On the other hand, Muscle Shoals in high water has a great excess of power. The two units and Norris Dam supplement each other. For the Tennessee Valley Authority to have an effective unit of power it should control both Muscle Shoals and Aurora dams."

Basis of Knoxville protest

In the local press on December 10 the Tennessee Public Service Company presented the complete text of its protest made before the Tennessee Public Works Advisory Committee in the matter of the application of the city of Knoxville for a federal loan of $3,225,000 with which to build a city-owned electric distribution system. After giving a description of the company's electric operations and transportation system and a chronological history of rate reductions and changes, the announcement explains the position of the company with respect to the proposed loan. "This company is thoroughly in accord with the desires of the citizens of Knoxville to obtain to the fullest degree the benefits growing out of the activity and undertakings of the Tennessee Valley Authority, and it is the desire of the company to co-operate with the citizens of Knoxville to the end that the people of Knoxville and of this vicinity may enjoy to the fullest measure such benefits. The company is opposing this loan to the city of Knoxville for the construction of a municipal electric distribution system in competition with the existing facilities of the company and does not feel that it is interfering in any degree with the natural development of this situation. Should the city of Knoxville secure the $3,225,000 which it has applied for to use to construct a distributing system, it must necessarily follow that such construction would simply mean a duplication of an investment in an existing property wholly adequate to the needs fothe city, and that the result of such action, carried to its logical conclusions, can only be disastrous to both the city and the company and result in the destruction of existing property and of existing property values. . . ."

P.W.A. Protest Made; More Requests Filed

Protesting the Public Works Administration's subsidizing policy to be unfair to private industry, the Illinois Manufacturers' Association has called upon the administration to change its procedure in respect to the use of federal funds for the construction of public projects to compete with existing privately owned plants. The association voiced its protest to the construction of a plant by a municipality alongside a privately owned plant and declared that it not only gives the non-taxed publicly owned enterprise an unfair advantage over a tax-paying private enterprise but undermines the savings of investors and reduces employment in the privately owned plant. The protest forwarded to Washington was made after the association had made a survey of proposed municipally owned utility plants for Illinois cities which, if the loans are granted, would duplicate the services of existing utilities. The resolution read in part: "We also express our conviction that an announcement of the establishment of such a policy (abandonment of present policy) will contribute greatly to the restoration of public confidence and encourage business enterprises to proceed with extensions and betterments of such character as will result in material improvement to the general business situation and corresponding reduction of unemployment."

Additional requests for federal aid for P.W.A. projects continue.

St. Louis, Mo., has resubmitted its application for a Public Works Administration grant of $450,000 and loan of $1,050,000 for extensions to the electric street lighting system.

Other recent applications for grants and loans filed with Missouri Advisory Board of the Federal Public Works Administration include the following: Summersville, $56,259 grant and loan for a water works and light and power system; Hayti, $29,700 grant and $101,800 loan for municipal light and power plant and also extensions to water distribution system; Perry, $63,590 for municipal electric light and power plant; Weston, $67,420 for same purpose. Laclede, $3,000 grant and $12,000 loan, estimated cost of improvements to electric light and power plant, $17,569; La Plata, $25,094 grant and $74,906 loan on plant and system to cost around $100,000; Memphis, $8,294 grant on improvements to existing system to cost $27,650, and Mount Vernon, $7,089 grant on an addition and improvements estimated at $23,630.

Among the applications for grants and loans recently forwarded to Washington for final action by the Missouri Public Works Administration are: Stanberry, $98,000 for a light and power plant and distribution system; Licking, $20,324 grant and $52,534 loan for a light and power plant and distribution lines, as well as for a water works.

A temporary lull in applications from other states is evident. No additional grants were announced this week.

Oklahoma court decision

In an important decision which members of the public works advisory committee believe will spur applications of Oklahoma municipalities for utility plant construction loans, the state Supreme Court has ruled cities and towns may vote bonds and levy for sinking fund requirements for municipal utilities in addition to a 15 mills maximum for current expenses to which all subdivisions of a county government are restricted by a constitutional amendment adopted August 15 this year.

In an appeal case filed by J. L. Adams against the city of Hobart, Okla., seeking an injunction to prevent delivery by city officials of the final $50,000 of a $250,000 bond issue voted in 1931 for waterworks extensions and improvements and to prevent the Kiowa County excise board from levying the sinking fund taxes required, the high court held sinking fund levies for retirement of public utility bonds are not required to come within the 15 mills maximum.

The bonds in question were sold to the Reconstruction Finance Corporation. While the question here involved waterworks only, the same principle will apply to gas or electric utilities. The court ruled amendment of one section of Article X of the constitution did not alter another section relating to levies for public utility projects.

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$4,000,000 Suit Filed Over Chicago Power Pool

Though suit charging the diversion of $5,000,000 a year of the funds of Commonwealth Edison Company, through participation in the Chicago power pool, has been filed by stockholders, that organization, through G. A. Ranney, vice-president, maintains: "The management . . . is convinced that the contract is fair and equitable, and that the outcome of the present action will justify their position." The suit asks an accounting of $14,000,000 allegedly paid from 1929 to date and asks that contracts be cor-

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Boulder Dam Progress Continues

Wide World

In the dark recesses of Black Canyon workers continue in year-round activity to bring Boulder Dam to successively higher steps toward its ultimate 730-ft. height. A comparison with "Electrical World," September 23, page 389, shows considerable progress to have been made in the past three months.

rected to eliminate any future payments.

Specific charges involve unfavorable position of Commonwealth Edison relative to other pool participants, changes in status of participants under fluctuating reserve capacity ratings and the purchase of unneeded capacities.

In reply Mr. Ranney further said: "Contracts of this character are based on sound economic principles of mass production and distribution, and have been adopted by various groups of operating utilities in the United States.

"In entering into and operating under the interchange energy contract the companies serving the Chicago district have received and followed the best available engineering advice.

State Line participation off

Northern Indiana Public Service Company has received favorable action upon its appeal to the Indiana Public Service Commission for permission to shift its interests in State Line generating station to Commonwealth Edison (ELECTRICAL WORLD, December 2, page 711).

In presenting the petition to assign, Dean Mitchell, vice-president, assured the commission that the Northern Indiana company could generate power in ample quantities at its Michigan City plant as cheaply as it could buy the energy from the State Line superstation. By eliminating the Indiana company's responsibility for more than 20 per cent of the fixed charges saddled on the State Line plant by the Insulls, a saving of between $100,000 and $150,000 annually can be effected, the commission was informed.

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New York Terminal Quits as D.C. Power Cables Burn

When compounding misfortune, cause not officially disclosed, burned out 27 d.c. track feeders in their conduits on Monday of this week and a substation fire ensued, traffic, lights and services in the Pennsylvania Railroad station in New York were completely suspended for some time, largely curtailed for a number of hours and partially restricted for several days.

Starting with a short circuit from a d.c. contact rail of the Long Island Railroad suburban service, the difficulties rapidly spread. Pennsylvania traffic, using a.c. overhead supply, was halted to permit firemen to fight the substation fire. As the difficulties centered around the feeder system, service could only be restored when burned-out cables had been replaced in the conduits or temporary sections run. Lights were out in the station and an adjacent hotel for about fifteen minutes. Long Island service was off for nearly four hours. Pennsylvania trains were delayed as much as twenty minutes.

—And a Prosperous New Year

More electrical energy was used in the week ended December 16, the consumption climbed back closer to 1931 levels, than has been used for some weeks. Perhaps it was dark days and not increased industrial use, but railroad carloadings for the week ended December 9 went up 8.5 per cent above the previous week and preliminary figures for individual carriers indicate a probable rise of an additional 5.7 per cent for the December 16 report. Add to these evidences the improvement in bituminous coal production in the most recent figures and do not forget the second sharp rise, this time 8 per cent, in steel activity to 34.2 per cent of capacity; add the less conclusive gain in automobile output, and the evidence seems to be heavy on the side of at least some months of better business to come. National retail sales organizations report recent business to average 10 per cent over last year; to be 30 per cent over in some instances.

Influences of the week have been a resumption of increase in the gold price by the government in its currency-wrecking campaign, which stood still for just two weeks; failure of commodities to respond to the Warren theory of juggling and more or less deep despond in security circles. Wall Street has been reservedly ecstatic of business possibilities ever since it ceased to be no more extravagantly fearful of imminent inflation. It has now slumped to watchful waiting. Speculators upset its equilibrium.

South Carolina Plans Wide Rural Electrification

At a cost of $25,000,000 South Carolina is planning a statewide rural electrification project. This latest manifestation of socialized government has reached the stage where a request for $5,912,800 of federal Public Works Administration funds as a first step in financing has been filed and is being reviewed by the South Carolina Public Works Advisory Board.

The initial expenditure under the proposed plan would set up 4,775 miles of lines to reach 16,775 consumers in rural areas over the entire state. The project when completed will involve a cost of $25,000,000. Of the $5,912,800 now sought, $1,452,100 is asked as a grant or gift from the federal government, and the balance would be covered by notes maturing from 1937 to 1956. The notes would be retired by revenue from the project.

The application and data were submitted to the advisory board of Ben M. Sawyer, State Highway Commissioner, in accordance with a 1933 legislative act.

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Doherty Backs Resortland

Backed by Henry L. Doherty of Cities Service a $500,000 program of society events and championship sports will be used to popularize Florida as a smart winter playground. Mr. Doherty owns a number of Florida hotels and has long displayed an active interest in the region.

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California Range Rentals

In explanation of Southern California Edison's abandonment of its range rental policy (ELECTRICAL WORLD, December 16, page 772) Vice-President W. L. Frost has stated: "The trial installation plan for ranges and water heaters was intended by us as an aid to and not a primary objective in making permanent sales. Complaints have come to us from many sources that the trial range and water heater plan is proving a serious handicap to the dealers in making permanent sales. Therefore we find it necessary to discontinue the trial range and water heater plan."

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California Act Approved

Returns from 80 per cent of the precincts in California indicate that the referendum vote upon the water power act (ELECTRICAL WORLD, October 21, page 523) will give popular approval to that measure. Preliminary returns showed 431,482 for and 403,921 against. Less than 40 per cent of the registered voters went to the polls.

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67-Ton Electric Steel Ingots

With the installation of what is said to be the largest high-frequency electric furnace in Europe in juxtaposition with a similarly large-capacity arc furnace the steel works of Thos. Firth & John Brown, Sheffield, England, will be able to produce electric process ingots more than 67 tons in weight and virtually free from non-metallic inclusions.

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Philadelphia Sells Lamps

In the fall lamp campaign sponsored by the Electrical Association of Philadelphia 1,262,700 lamps with a retail value of $252,517 were sold. In this campaign, which embraced the Philadelphia metropolitan trading area, 1,150 dealers were registered as actively participating. Comparative figures disclosed an increase in lamp sales of 210 per cent over 1932 in the territory during the period covered by the campaign. This was ascribed by dealers and distributors as almost entirely due to the Electrical Association's promotional activity.

Coming Meetings

American Physical Society, annual meeting, Boston, Mass., December 28-30. W. L. Severinghaus, Columbia University, New York.

American Institute of Electrical Engineers—New York, N. Y., January 23-26. H. H. Henline, 29 West 39th St., New York.

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N.E.M.A. Code Rehearing; Truck Makers Assigned

Though the all-too-stimulating light and power code has been cautiously set aside for later consideration by National Recovery Administration officials, Administrator Johnson has announced that a public hearing will be held January 4 regarding possible amendments to the manufacturing code proposed by the National Electrical Manufacturers Association and other groups in the industry. In scheduling the hearing the administrator pointed out that since the electrical manufacturing code became effective—it was the fourth code to be approved by the President—experience with it and in the operation of later codes has indicated defects in the electrical code which both the administration and the industry realize should be remedied.

One of the proposed amendments, for example, would modify the maximum hours provision of the code, which now prescribes a 36-hour maximum work week for processing employees, but does not specifically limit the amount of overtime to be permitted in peak production or emergency periods. Simultaneously with announcement of the hearing, General Johnson announced the appointment of Alvin Brown, executive officer of the administration, as assistant to General Johnson himself, to be the administration member of the electrical manufacturing industry code authority. Mr. Brown will serve, it was announced, for six months or until such time as his successor is appointed. Mr. Brown was formerly assistant director of the budget.

Truck makers code

Producers of electric industrial trucks, tractors and cranes using low voltage motors wish to form a subdivision under the fabricated metal products manufacturing industry code, approved November 2 by President Roosevelt. The Electric Industrial Truck Institute, Inc., which claims to speak for 95 per cent of the industry, has submitted a supplementary code to the National Recovery Administration. Labor provisions of the fabricated metal products code are specifically accepted and made a part of the proposed electric truck code. A supplementary code authority would be formed, to administer the sub-code for the division. Each member of the industry would be required to use an adequate cost accounting system, to file his price lists and to abide by the prices quoted. Other trade practices listed as unfair, and which would be forbidden, include inducing breach of contract, disparagement of competitors, misbranding, guarantee against price declines and post-dating invoices. Acceptance has not yet been made by NRA.

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Water Heaters Rented on Trial in Milwaukee

Latest recruit to the ranks of electric utilities renting appliances, Milwaukee Electric Railway & Light Company for December only offers 250 electric water heaters to be installed on one year's trial without installation charge and, if the customer is not satisfied, without any removal charge. The company offers a 50-gal. heater at a rental of $1.25 per month. If the customer decides to purchase the heater at any time within the year a sum equal to one-half of the rental paid will be applied on the purchase price. The remainder of the purchase price will be collectible in 24 equal installments. In addition to the 50-gal. size, 80 and 120-gal. heaters are also offered at slightly higher rentals.

In March of this year the Milwaukee company included in its regular rates a water heating rate that had been on trial for about a year previous. This rate applies specifically to the lower unit of a double-unit water heater. The lower unit is connected with time clock and thermostat on a special meter and receives current during off-peak hours established by the company. The upper unit of the heater is connected through the regular house service meter and is intended to be used only when extraordinary hot water demands occur. For the lower unit a flat rate of $1.89 per month per kilowatt of connected load is charged provided that the energy used by this unit is not less than 189 kw.-hr. per month. If the consumption is less than 189 kw.-hr. it is billed at a rate of 1 cent per kilowatt-hour. If the consumption exceeds 189 kw.-hr. the flat rate applies. Energy used by the top unit is at the regular residence rate, which is modified in the case of a water heater installation, so that the secondary charge in the rate is for 75 instead of 150 kw.-hr.

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Hetch-Hetchy Shutdown

Annual curtailment of operations at the power station of the Hetch-Hetchy project in California will start about January 10, it has been announced. Resumption is likely near March 25.

Samuel Insull Loses; Has Until January 31

Acceding to the request of the refugee Chicago utility man, the Greek government has given Samuel Insull until January 31 to be elsewhere than in the isles of Greece. Twice beaten in its attempts to secure Insull's extradition the United States government has succeeded in having renewal of his temporary residence permit withheld. Advised of the decision, Mr. Insull dejectedly told correspondents: "I'm going to bed and I'm staying there."

Just what may happen next is problematical. The Greek government has agreed to visé his passport to any country that he might choose, but that document has long since been revoked by this country. The United States has no extradition treaties with China, Egypt, Persia, Afghanistan and the internationalized section of Morocco.

Receivership fees disputed

Following "revelations" last week in the federal court in Chicago before Judge Evans that Samuel Insull dictated the naming of receivers for his collapsed utilities, Samuel Insull, Jr., denied that his father had done so. John E. Wing, former Insull attorney, and others, testified as to the dictation of receivers by the deposed utility man.

Judge Evan A. Evans of the United States Circuit Court of Appeals in Chicago overruled the motion of attorneys for Calvin Fentress, receiver for the Insull Utility Investment, Inc., to strike out objections to the payment of $50,000 in receiver's fees. Attorney Samuel Ettelson, in his objection to payment of the fee, charged that there was collusion in the receivership. Attorney Ettelson charged that the receivership litigation was dominated and directed by the Insulls. The effect of the ruling of Judge Evans is to allow Attorney Ettelson to bring in proof of his charges. "It is sufficient if the objection challenges the allowance of the presented claim and apprises the court of the general ground of objection," Judge Evans said. "The facts necessary to show collusion must be established."

Government sues for taxes

Charging Samuel Insull to have failed to pay $176,898 in taxes on his 1929 and 1930 income and that he is claiming $21,758 in tax refunds not due him, the United States government has started a $199,000 income-tax suit against Mr. Insull.

That the tax case may strengthen the fight of the government to extradite Insull from Europe has been disclosed by Assistant Attorney General Joseph B. Keenan. While confident that the return of Insull can be obtained on charges pending against him in Chicago, Mr.

Keenan said that the tax charge might be used if necessary.

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Associated Plan Progresses; Barstow Protests, Deposits

Debentures of all series of the Associated Gas & Electric Company to the amount of $95,000,000 have been exchanged under the plan of rearrangement of debt capitalization (ELECTRICAL WORLD, May 20, page 629) by more than 40,000 holders, representing about 36 per cent of the $260,000,000 debentures outstanding. In a letter to debenture holders the company explains that nearly three-quarters of the new debentures, which are reserved under the first of the three exchange options, have been issued and that early closing of this option is likely. Holders of stamped debentures under an agreement dated May 18 are asked to deposit them by December 30, with written notice as to the option they select. After that date the Associated Gas & Electric Securities Company, Inc., has the right to select which option shall apply to the stamped debenture.

In a statement made this week W. S. Barstow, who organized the General Gas & Electric Corporation, now part of the Associated Gas & Electric System, characterized the plan as unfair and inequitable in that it is unduly burdensome on the debenture holders and asks too great a sacrifice of them. "To my mind," he said, "a fairer plan would have given each debenture holder half of his principal in a fixed interest bearing obligation (which might be graded to meet the conditions of the present depression) and half of his principal in an income obligation. I tried without success to have the plan so amended, but the management of the company insisted that it could not make any substantial change in view of the federal securities act of 1933. I have, therefore, very reluctantly accepted debentures under option one in exchange for my holdings, and my immediate associates have done likewise. We feel that this action has been forced upon us by the position taken by the management and I desire my friends and acquaintances to know that it should not be taken as approval either of the plan or the management of the company. . ."

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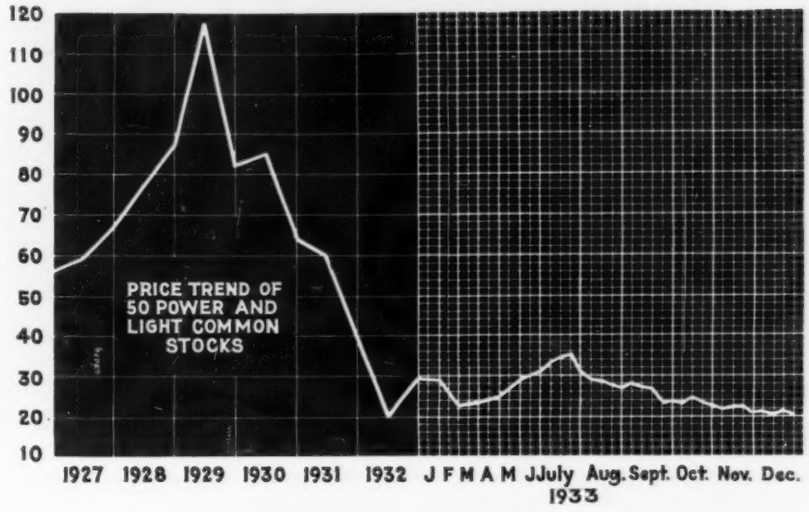
Sodium Lamps for Wallingford

Following experiments elsewhere (ELECTRICAL WORLD, November 25, page 675) the borough of Wallingford, Conn., has purchased eight 10,000-lumen sodium-vapor lamps of the type some months ago installed on the Balltown Road near Schenectady (ELECTRICAL WORLD, June 24, page 815).

Stocks Decline Once More



Taking their cue from the general market, which showed definite weakness, electric light and power common stocks, as measured by the "Electrical World" average, fell to 20.6 from 21.7 last week

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Several Dividend Changes

Cleveland Electric Illuminating Company has increased the quarterly dividend on its common stock to 50 cents after a previous declaration of 40 cents. Standard Gas & Electric has declared a quarterly dividend of 45 cents on the $6 prior preference stock and 52½ cents on the $7 prior preference stock; both issues are cumulative preferreds. Standard Power & Light has declared 52½ cents on its 7 per cent cumulative preferred stock. Central Illinois Public Service has omitted dividends due on its $6 and 6 per cent preferred stocks. West Texas Utilities has declared a quarterly dividend of 75 cents on its $6 cumulative preferred. Northern States Power (Delaware) has omitted dividends on its class A common.

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NIRA Constitutionality Challenged

Milwaukee Electric Railway & Light Company, involved with an electrical workers' union and the Wisconsin State Federation of Labor over the right of employees to force negotiations with any other than the company union (ELECTRICAL WORLD, December 2, page 709), has announced through George H. Gabel, attorney, that suit will be carried to higher courts to test the constitutionality of the national industrial recovery act.

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Kansas Merchandising Appeal

Announcement has been made by Roland Boynton, Kansas Attorney-General, that he will appeal to the United States Supreme Court from the ruling of the Kansas Supreme Court holding unconstitutional the so-called merchandising law designed to prevent utility companies from selling appliances and merchandise (ELECTRICAL WORLD, June 17, page 777, and October 14, page 487).

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Birmingham Interest on Deposits

In accordance with a custom started last year, the Birmingham Electric Company will allow customers credit for interest earned on service deposits, making the adjustment on January bills. This year's credits approximate $35,000.

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New Financing Planned

Seeking to qualify under the rigorous terms and provisions of the new securities act, Long Island Lighting Company has applied to the Federal Trade Commission for permission to issue $6,845,500 of refunding mortgage bonds.

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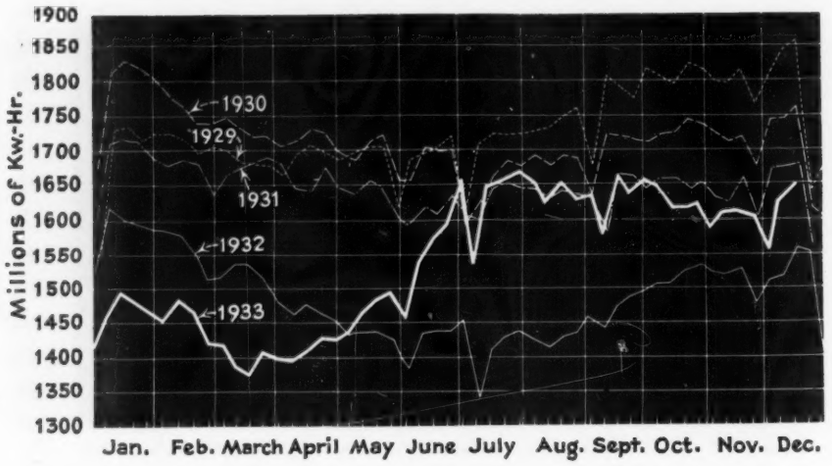
Cuban Row Postponed

Following an eighteen-hour conference of employees and officials of the Compania Cubana Electricidad it has been announced that the threatened strike which could presumably have thrown the island into electricity-less days and nights (ELECTRICAL WORLD, December 16, page 773) has been postponed for 30 days pending further compromises. The company is said to have conceded 30 of the 41 employee demands. Consideration will be given to the remainder. The company has petitioned the Supreme Court regarding the presidential rate-reduction decree.

Larger Energy Output



Exceeding that of the preceding week by 25,000,000 kw.-hr., energy production in central electric light and power plants during the week ended December 16 rose to 1,644,018,000 kw.-hr., the Edison Electric Institute announces. While the increase was smaller than in 1932 it was considerably larger than in 1931.

The effect has been to diminish the gain over last year from 6.6 per cent in the week of December 9 to 5.2 per cent, but at the same time the output approached closer to that of 1931, missing it by only 1.9 per cent.

In New England and the West Central region the gain over 1932 increased, elsewhere it diminished somewhat, but the Mountain states percentage continues largest.

Weekly Output, Millions of Kw.-Hr.

1933	1932	1931
Dec. 16...1,644	Dec. 17...1,563	Dec. 19...1,676
Dec. 9...1,619	Dec. 10...1,519	Dec. 12...1,672
Dec. 2...1,554	Dec. 3...1,510	Dec. 5...1,671
Nov. 25...1,608	Nov. 26...1,475	Nov. 28...1,600
Nov. 18...1,617	Nov. 19...1,532	Nov. 21...1,655

Per Cent Change from Previous Year

Region	Week ended Dec. 16	Week ended Dec. 9	2 Wks Dec. 2
New England	+ 7.1	+ 6.4	+ 6.8
Middle Atlantic	+ 4.1	+ 6.2	+ 3.0
Central Industrial	+ 8.2	+ 8.8	+ 8.9
West Central	+ 2.4	+ 0.8	+ 0.5
Southern States	— 0.9	+ 0.5	— 0.4
Rocky Mountain	+14.6	+21.0	+30.3
Pacific Coast	+ 1.0	+ 3.2	+ 4.7
United States	+ 5.2	+ 6.6	+ 5.9

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British National Grid to Be Further Expanded

Formal notification has been extended by the British Central Electricity Board to authorize suppliers in northwest England and northern Wales of the introduction of a grid tariff to become operative on January 1 next.

Twenty-nine generating stations in the area have been selected for permanent operation, including two new stations. Interconnecting the power stations and 51 transforming and switching stations 316 miles of main transmission lines and 199 miles of secondary lines have been erected. Extensions link up the area with south Scotland in the north, mid-east England in the East and central England in the south, while at Crewe connection is established with the hydro stations of the North Wales Power Company.

The area to which the new tariff will apply extends to 9,082 square miles and includes the counties of Cumberland, Westmorland, Lancashire, Cheshire, Denbigh, Carnarvon, Flint, Merioneth, Montgomery, part of Derby, part of Shropshire, and part of Cardigan. The bulk of the population of more than 7,000,000 people is centered in the highly industrialized region in Lancashire and Cheshire, north and south of which is agricultural territory.

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Washington Authorities Act on Utility-Budget Powers

Challenging the $36,000 salary of President F. T. Post of the Washington Water Power Company and three other items on the 1934 budget of that company and its two subsidiaries the Washington Department of Public Works has filed a complaint against the utility, the first under the new laws giving the department review powers over the budgets of privately owned public utilities. In its complaint all but $15,000 of the annual salary received by President Post is challenged. Other items objected to are $10,043 in donations "in connection with the operations in Washington cities," $90,918 in service fees paid to the Electric Bond & Share Company and $9,626 in dues and payments to "organizations in Washington cities and towns."

The total of the challenged items is $131,587. "The objection is to the payment of said donations, dues, service fees and excess salary for the reason that the same are not necessary or proper charges in so far as the ratepayers of the utility are concerned," the complaint set forth.

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Oregon Creates Board to Supervise Bonneville

Power legislation at the special session of the Oregon lawmakers, just closed, was confined to the creation of an interim committee to make a study of the power situation for the benefit of the next regular session. The committee, to be known as the "Bonneville Power Commission," is to consist of seven members, two to be members of the state Senate, two to be members of the House and three to be named by the Governor from the state at large.

Duties of the commission as outlined in the resolution creating the body shall be "to study and report to the next legislative assembly on all matters in relation to Bonneville power development, particularly as to prospective markets for power and prospective revenues; the need of transmission lines and distribution systems; by whom said transmission lines and distribution systems shall be constructed and maintained and probable cost thereof; the allocation of the cost of the Bonneville development as between power and navigation; the division of the power produced as between the states of Oregon and Washington; the price at which the product is to be sold and to whom, and the manner in which the state can best co-operate with the federal government in order to insure the success of the undertaking."

A measure creating a state power commission with authority to supervise the development of a state-owned hydroelectric system died in the confusion of the closing hours of the session when the Senate failed to approve amendments written into the bill by the House.

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Arrow-Hart & Hegeman

The United States Supreme Court has granted Arrow-Hart & Hegeman Electric Company a review of a lower court decision upholding an order of the Federal Trade Commission requiring the petitioner to divest its holdings in either the Hart & Hegeman Manufacturing Company or the Arrow Electric Company on the grounds that 59 per cent of the products of one of the companies was sold in active and direct competition with the other, and that the combined annual sales of the two corporations constituted 24 per cent of the total sales of the entire industry.

New York Metal Prices

	Dec. 12, 1933 Cents per Pound	Dec. 19, 1933 Cents per Pound
Copper, electrolytic	8.00	8.25
Lead, Am. S. & R. price	4.15	4.15
Antimony	7.25	7.25
Nickel ingot	35.00	35.00
Zinc, spot	4.85	4.85
Tin, Straits	53.00	53.30
Aluminum, 99 per cent.	23.30	23.30

Power Again an Issue in Legislation in West

Plans to bring the power issue before the special session of the Washington State Legislature, now in session, have been announced by Kenneth Harlin, Seattle rate engineer and co-worker of United States Senator Homer T. Bone in the latter's power program. Senator Bone will introduce in the state Senate a resolution providing for the submission of a constitutional amendment to the voters in 1934 which will put the state in the power distribution business and create a super-power system under which electrical energy from existing municipal projects and the Grand Coulee and Bonneville power dams would be made available to all communities in the state.

Power would be sold at wholesale to power districts authorized in the Grange power bill, adopted by the voters several years ago, Mr. Harlin said. A similar resolution introduced in the last session of the Legislature was defeated by a small majority. At the last session a Bone power measure enacted opened the way for cities without municipal plants to purchase power from those owning and operating power projects.

Operation of the measure, however, was held up through a referendum instituted by its opponents. The Bone bill will be on the ballot at the 1934 general election, supported by Senator Dill, who declared: "I am more interested in the approval of this measure by the people at the general election in 1934 than I am in my own re-election to the United States Senate."

Senator Bone declares that he is opposed to giving any private company a monopoly on the power distributing business from the Grand Coulee Dam development under way. "If the private companies are permitted to sell electric energy from the Grand Coulee plant they should do so in full competition with a publicly owned distributing system," he declares.

Recommendation of the Governor as to taxing the revenue of public utilities for the benefit of the schools and as to providing for the state transmission of Bonneville power were not followed by the Oregon Legislature at the special session which recently adjourned. As far as public utilities are concerned, it contented itself with correcting technicalities in existing laws and with providing for an interim committee to study the question of the distribution of Bonneville power to report at the next regular session in 1935.

Proposal to bring in new tax money for the relief of the distressed school districts by a tax on public utility revenues was met with a flood of protest from employees and stockholders in all parts of the state. This movement, starting with letters spontaneously inspired and written by a few employees of the Portland General Electric Company, rapidly spread without the impetus of any organization until the thousands received by the legislators convinced them of the inequitableness of the proposal and resulted in the quiet demise of the measure in committee. School relief was provided for by a privilege tax of 1½ per cent on retail sales of personal property and utility services, same to be paid by the purchaser.

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Mississippi River Plant Meets With Opposition

In a request filed with the Federal Power Commission, Congressman John J. Cochran of St. Louis has asked that body not to issue a preliminary permit for the construction of a hydro-electric dam and power plant and bridge across the Mississippi River at the foot of Marceau Street, St. Louis, as requested by the Association of Citizens for Riverfront Improvement of St. Louis, until a public hearing can be held on the application. The association, in its application for the preliminary permit, stated that it is planning to construct a hydro-electric power dam and plant and a double-deck bridge to be used for both highway and railroad purposes. It also asked for priority over any and all other riverfront development projects. Congressman Cochran has notified Mayor Bernard F. Dickmann of the filing of the association's petition for a preliminary permit and asked him to advise if the city desired to be heard.

Roy B. McWhorter, chief engineer for the Federal Power Commission, has asked the association to advise whether it is licensed to do business in Illinois and to furnish the commission with a photostat copy of the drawing of the proposed improvements, a profile drawing of the river, extending upstream so as to show the probable flood effects, the reason for the selection of the site named, a statement as to the equipment to be installed and capacity of plant, and the probable market for the power to be generated.

The cost of the dam, power plant and bridge has been estimated at $40,000,000 to $50,000,000. The association proposes to obtain most of the funds needed from the Federal Public Works Administration.

Major New Construction This Week

Northern States Power Company plans new transmission line from point near Jim Falls to Rice Lake, Wis., and vicinity. Cost about $150.000.

Transformers, motors, controls, conveyors, etc., will be installed by American Zirconium Corporation, subsidiary of Glidden Company, Baltimore, Md., in St. Helena industrial district. A $500,000 project.

DeLand, Fla., plans city-owned electric light and power plant. Fund of $350,000 has been authorized through federal grant and loan.

Board of Transportation, New York, N. Y., plans new central power substation, third rail construction, car shops, signal apparatus, etc., for new 18-mile section of Eighth Avenue subway system. Federal loan of $23,160,000 has been secured, of which about $18,000,000 will be expended for labor, equipment and materials. Work begins early in 1934.

Lexington, N. C., plans steam-electric power plant for city and neighboring service. Fund of $645,000 is being arranged through federal aid.

Until January 5, Aberdeen, S. D., asks bids for electric generator and control equipment for waterworks station; also for electric pumping machinery and auxiliaries.

K. Taylor Distilling Company, Frankfort, Ky., plans extensions and improvements in plant at Forks of Elkhorn, near Frankfort, at cost of about $275,000.

Lodi, Calif., is arranging fund of $580,000 for new city-owned hydro-electric generating plant on Mokelumne River, and construction of transmission line with power substation to city. Work scheduled to begin early in 1934.

Appropriation of $132,000 authorized by Tennessee Valley Authority for construction of electrical distribution lines and substation facilities in rural districts, northeastern part of Mississippi.

Motors, pumps, transformers, conveyors, etc., will be installed by White Petroleum & Refining Company at Cambridge Springs, Pa. Cost about $100,000.

Oskaloosa, Iowa, plans city-owned light and power plant. Federal grant and loan for $460,190 being arranged.

New General Electric Institute

Formal opening of the new General Electric Institute at Nela Park, Cleveland, was accomplished December 22. This exhibit, involving a number of new demonstrating and testing features, supplants the former Kitchen and Lighting Institute of the company.

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H D Electric Formed

Successor to Associated Engineers Company, the H D Electric Company has been formed in Chicago. M. R. Hoffman is president.

As to Rates——

• Consolidated Gas Company's and subsidiaries' electric and gas rate cut, ordered for December 13, has been twice deferred following the refusal of Supreme Court Justice Gilbert V. Schenck to rule immediately on the constitutionality of the reduction. In his argument before Justice Schenck, Niele F. Towner of Albany, of counsel for the companies, alleged that if the original order of the commission were to take effect it would mean a loss in revenue of $8,871,000. Jacob E. Goetz of New York, also for the companies, termed the ruling of the commission as an unjustifiable precedent. He stressed the dissenting memoranda of Commissioners Van Namee and Brewster, which held the emergency rates, slashing the earnings of the consolidated group to 6 per cent of its capitalization, to be illegal. He also argued that the commission arrived at its decision by a "hybrid process unprecedented in law." Col. Charles G. Blakeslee, commission's counsel, declared that the emergency rates are neither confiscatory nor a source of irreparable damage. He insisted that the rates would permit the companies to earn 7.98 per cent on their capitalization. He pointed out that the companies had accumulated a surplus and reserve of $206,000,000 in 1932 under the rates now in effect. At the suggestion of Justice Schenck he conferred with Milo R. Maltbie, chairman of the commission, and later informed the court of the agreement to delay the effective date of the reductions.

• Edison Electric Illuminating Company of Boston's connection with the New England Power Association was the subject of testimony presented before the Massachusetts Public Utilities Commission at a hearing last week. Frank H. Sullivan, representing one group of petitioners seeking a reduction in rates, interrogated Mr. Baylies, president of the company, as to the relationships involved. Mr. Baylies stated that there is now no financial connection between the Edison company and New England Power Association, explaining: "An agreement was made on January 18, 1926, to subscribe to 20,000 common shares at $50 a share, which was paid in installments from January, 1926, to February, 1927. We received interest at 6 per cent on the installments. We received dividends amounting to $15,000 in 1927. The interest that was purchased was sold on June 29, 1927, at $1,300,000. The purchase was part of the general policy to co-operate in a friendly and close way with the New England Power Association.

• Illinois Northern Utilities Company has been authorized to reduce its rates in the city of Geneseo approximately 16 per cent to meet municipal competition. The municipal plant rates are about 10 per cent under the utility's former rates. The commission refused to order the company to remove its property from the city streets, and pointed out that the state courts are open for settlement of this controversy. Counsel for the city indicated that court action for such removal would be sought. Counsel for the commission pointed out that the company, although denied a franchise by the City Council of Geneseo, continued to operate and is serving customers who failed to take the municipal service at reduced rates. Not only did the Geneseo City Council refuse to grant the company a new franchise after the old one expired, but it ordered the utility to get out. It was given 90 days to remove its wires, poles and other properties from the streets. The utility ignored the order. Instead it went to the commission and sought permission to establish a schedule of temporary rates that would permit of competition with the municipally owned plant.

• Georgia Power Company and representatives of municipalities distributing electric power to their own citizens last week discussed a rate reduction. It was announced that a tentative agreement calling for a cut of between 10 and 12 per cent was made. There are 23 cities and towns in Georgia which buy current from the power company and operate their own distributing plant. Charles A. Collier, vice-president of the company, after hearing the demands made by the representatives of the municipalities, offered a total reduction of $50,000 on the approximate $700,000 bill paid by the towns. Chairman J. P. Wilhoit of the Public Service Commission, sitting in on the meeting, said that the commission had not demanded any action on the part of the power company, but was "merely aiding the company and the towns to get together."

• Texas Electric Service Company has announced that it will reduce its commercial rates, effective January 1, to the level of the rates charged in Dallas. The City Council was on the eve of making application to the Federal Public Works Administration for a loan and grant of $2,228,000 for the construction of a municipal electric light and power plant, but in view of the action taken by the electric company has abandoned its plans. The reduction in rates will effect a saving of approximately $150,000 annually to commercial consumers.

• Public Service Company of Indiana, through its comptroller, has submitted evidence before the Public Service Commission, in connection with the rate case involving the utility, that reductions in consumer cost for electricity amounted in some cases to as much as 59 per cent. Denying that the $34,800,000 valuation placed upon the company's properties by Sherman Minton, Public Service Commission counselor, was correct, company counsel set the valuation at $50,662,000.

• Quebec Power Company will be asked to revise its present rates by the city of Quebec. Proposals of Mayor Lavigueur were approved by the administration committee. The Mayor's proposals suggested the saving of $250,000 by the drawing up of a new contract and a general reduction of $400,000 in rates at the conclusion of the present contract in May, 1935.

• Alabama Utilities Company has been ordered by the Public Service Commission to revise its 25 existing rate schedules on light and power for cities and towns in southwest Alabama into a uniform schedule estimated to result in average reduction of 17 per cent to residential consumers and 12 per cent to commercial consumers. The reduction will vary considerably because of the large number of rate schedules that have been in effect under old franchise and contracts. Commission officials said they could not compare this uniform schedule with recent reduced rates ordered for the Alabama Power Company throughout Alabama, because today's rates were not based on room charges.

• Northern Indiana Power Company's electric consumers at Greentown and New Market have recently been granted rate reductions amounting to approximately 8 per cent by order of the state Public Service Commission.

• Duke Power Company and its subsidiary, the Southern Public Utilities Company, must make further rate reductions of approximately $1,000,000, according to papers filed with the South Carolina Railroad Commission by its electric utilities division, as part of its proceedings in its investigation of these companies. Both companies serve Piedmont counties in South Carolina. An analysis of the affidavits and papers filed by the utilities division would indicate that, on the basis of a fair return of 6 per cent on the reproduced value of the property of the Duke Power Company "used and useful in South Carolina" claimed by the division to be $30,224,189, the rate should be reduced by approximately $448,901, and of the Southern Public Utilities Company on the basis of the division's claimed value of the company's property at $7,353,012 by approximately $551,708, or a total of $1,000,609 for both companies. The procedure now before the commission is the outcome of an order issued by it several months ago (ELECTRICAL WORLD, January 28, page 120). In response to this and subsequent orders, the two companies some days ago made answer to the commission and the affi-

davits and papers filed by the electric utilities division are in response to these answers. Following the filing of replies by the companies, the commission will call a hearing.

• Denver, Colo., City Council has been petitioned by civic organizations to institute an immediate investigation of electric rates of the Public Service Company of Colorado. An ordinance calling for an entirely new rate structure for gas and electricity has been threatened. The petition states that "after comparison of light rates charged in Denver and other cities it has been determined to the satisfaction of these petitioners that the electric rates are as unreasonable and exorbitant as the gas rates."

• Telluride Power Company has been ordered by the Utah Public Utilities Commission to reduce rates for electric service in the southern Utah territory by 10 per cent. In ordering the reduction the commission took cognizance of the fact that earnings of the utility would be lowered below the point generally considered as a fair return, but held that "it would seem that the basic principle or rule laid down by the courts is that regardless of what the effect may be upon the costs of operation of the utility or its financial conditions, the cost to the consumers should in no event exceed what the services are reasonably worth to them."

The commission showed that during the last five years the company earned an average of 4.07 per cent upon its fixed capital investment and in 1932 earned only 2.59 per cent.

Following the trend of opinion in several recent regulatory decisions, the order stated, "it is quite true that any material reduction of the rates of the company would mean service at rates quite generally held by the courts to be confiscatory, but it should be remembered that the company has voluntarily chosen the field of its operations and accepted the franchise provisions granted it by the state with the avowed purpose of the development of its potential resources. With such purpose in view it has been and is now pioneering quite as much as were its patrons engaged in agricultural, mining and commercial pursuits. We believe it should, therefore, in some measure be held to meet the exigencies of the times with them, if for no other reason, as a matter of self-interest and preservation."

• Memphis Power & Light and official representatives of that municipality have agreed upon a reduction in electric and gas rates which will save consumers there about $400,000 a year. Residential and commercial lighting and small power users will benefit most from the electric rate cut. An average decrease of 21 per cent in the top charges for those purposes will be made when the new rate becomes effective.

Municipal Items

RUSSELLVILLE, ALA.—By a vote of 405 to 103 citizens have indorsed municipal operation of a power plant and authorized application to the Public Works Administration for a loan of $65,000 to erect such a plant to use electricity from Muscle Shoals.

ROCKFORD, IOWA. — Equity action brought by the Iowa Public Service Company against this town and the Fairbanks Morse Company has been taken under advisement by United States District Judge Molyneaux. The suit is to set aside a special election empowering the Council to go ahead with the construction of a Diesel-powered plant under a contract award. The case was heard at the December term of United States District Court here, with attorneys given twenty days in which to file written briefs in connection with evidence taken by the court in connection with the action brought by the utility firm now serving the city with electrical energy. The legal aspect, of more than passing interest to other cities, hinges on allegations to the effect that the plaintiff in giving the utility a long-term franchise invalidates the present contract.

ALLEGAN, MICH.—Consumers Power Company has obtained a temporary injunction restraining the city from proceeding with plans to build a hydro-electric plant as a P.W.A. project. Hearing has been set for Grand Rapids. The company contends that the city is bonded to its limit, despite approval of an increased limit by voters; that the election was improperly held, and that the project is illegal under P.W.A. rules.

AUSTIN, TEX.—Improvements to the electric light and power plant and water supply system to cost $400,000 will soon be undertaken. A loan and grant in that sum has just been obtained for the purpose from the Federal Public Works Administration. Among the improvements will be the installation of a new 7,500-kw. turbine, condenser and other equipment costing $290,000.

BELLINGHAM, WASH.—At a recent city election the voters rejected the proposition to issue $150,000 in utility bonds for establishment of a city-operated power plant.

MILWAUKEE, WIS. — Mayor Hoan's proposal for a municipal electric plant undertaking provides for a plant to serve municipal properties only. Such a program would require the initial expenditure of not more than $1,000,000, it is estimated, a request for which would be made to the P.W.A.

KOKOMO, IND.—At a special meeting of the City Council Mayor Henry Quigley and the Board of Public Works have been authorized to contract with Burns & McDonald for a complete survey of the electric utility situation in Kokomo. The city is contemplating a request for a reduction in rates and, if this fails, threatens to establish a municipal plant.

ST. PAUL, MINN.—Voting unanimously, City Council has broken off all franchise negotiations with the Northern States Power Company, and Mayor Mahoney has launched his plan for a municipally owned gas, electric and steam heating service. An ordinance was introduced, signed by both Mayor Mahoney and Commissioner C. R. May of the Department of Public Utilities, which provides for the establishment of a bureau of municipally owned public utilities to be in charge of the commissioner of utilities, finance and public works. It provides details for the operation of municipally owned electric, gas and steam heating utilities, but does not provide for the financing of them.

CORAOPOLIS, PA.—Opposing the Duquesne Light Company's offer to spend approximately $82,000 on the electric and water plants, a citizens' committee representing 2,500 property owners has asked the Pennsylvania Public Service Commission to investigate the comparative costs of municipal and utility company's electricity to light the streets of the borough for a period of fifteen years. The Duquesne Light Company has a 25-year contract with the borough.

CHATTANOOGA, TENN.—A special referendum will be held on the question of constructing its own electric distribution facilities as soon as a survey is completed to determine the cost of such facilities. Power would be purchased from the Tennessee Valley Authority. If the referendum is favorable to such a program the city will seek legislative authority to issue bonds. The city is served by Tennessee Electric Power.

CŒUR D'ALENE, IDAHO, has voted 2½ to 1 in favor of a $600,000 bond issue, half of which is to purchase or construct a municipal light and power plant and the other half to purchase or construct a water system. A two-thirds majority was necessary. This is the third vote the city has taken within two years on the question of municipal ownership, previous revenue bond issues having passed by large majorities, but having been overruled in the state Supreme Court.

LA JUNTA, COLO., taxpayers after a mass meeting asked the City Council to forego asking a $300,000 loan from the Public Works Administration for a municipal electric plant. The City Council acquiesced.

WASHINGTON—A tax of 3 per cent on the gross revenue of municipally owned utilities, levied as part of a new business tax law in the State of Washington, has been held to be constitutional by the County Superior Court.

Arguing the Case for Higher Voltage Generators

By C. M. LAFFOON
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

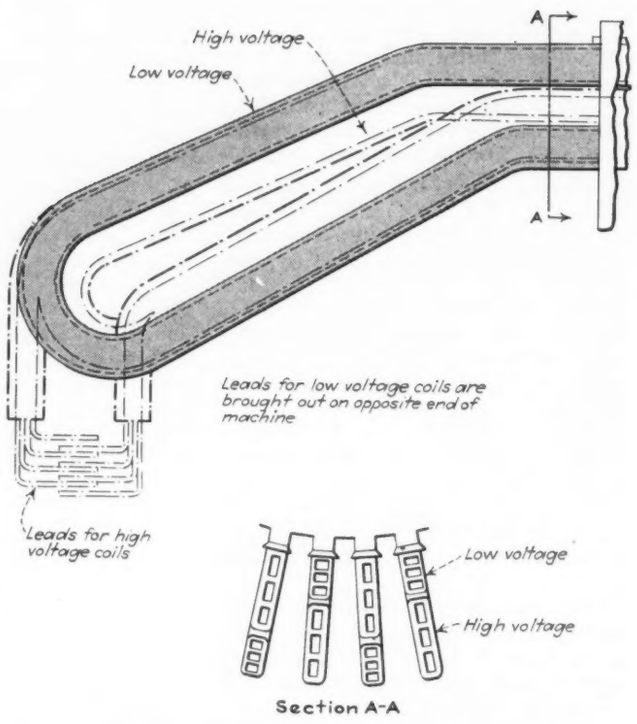
RELATIVELY high kva. output per unit of voltage has resulted from the tendency to keep on increasing the kva. ratings without using higher generated voltages. In practice these voltages lie within a fairly narrow zone, but nevertheless it cannot be said that there is any one generally used value. Graded insulation should make much higher voltages possible, technically and economically.

Generators which have kva.-voltage ratios of high magnitude require so few stator conductors that it is necessary to use the minimum number of slots, with a one-conductor-per-slot type of winding, and chord the winding appreciably more than is normally considered the best design practice. Concentration of large currents in the stator slots and the abrupt changes in the polarity of the stator ampere-wires due to large chording of the one-conductor-per-slot type of winding introduce harmonics of large magnitude in the stator demagnetizing m.m.f. These m.m.f. harmonics react on the rotor and result in additional losses which not only reduce the ampere-turn output of the rotor but decrease the efficiency of the generating unit.

The upper limit in the value of the ratio of kva. to voltage for which generators of conventional design and performance can be built is approximately 12.5 for small generators and 13.2 for the largest four-pole generating units. On the basis of this limitation in the kva.-voltage ratio the maximum generator rating at 600 volts would be 7,500 kva., whereas at 13,800 volts ratings as high as 185,000 kva. can be obtained on four-pole, 1,800-r.p.m. turbo-generators. Several two-pole, 3,600-r.p.m. generators have been built for 6,250 and 7,500-kva. ratings at 480 and 600 volts respectively. The 183,333-kva., 1,800-r.p.m., 90 per cent power-factor turbo-generator now under construction for the Philadelphia Electric Company has a stator winding designed for 13,800 volts and no design or performance difficulties were encountered on account of the specific voltage requirement.

Low ratios present tooth difficulties

In the case of generators with very low kva.-voltage ratios a large percentage of the tooth zone portion of the stator core is required for the insulation on the stator coils. The increased insulation thickness necessitates the use of greater copper section and increased heat-dissipating surface of the stator coils in order to meet standard temperature limitations. With a greater percentage of the stator periphery used by the stator copper and insulation there is less section of the tooth zone available for the magnetizing flux, and it is necessary to increase the dimensions of the core in order to avoid excessive iron losses in the teeth. The increase in core dimensions results in increased windage friction losses and the wide stator slots with respect to the air gap length introduce additional pole-face losses under both no-load and full-load conditions. In either of these two extreme cases the generators are larger, more costly and less efficient than generators which have a more favorable ratio of kva. to voltage.



High and low voltage windings alternate in slot positions

As a general proposition it can be stated that there is a most economical voltage range for which turbo-generators can be built. As the rating goes up the spread of the range decreases to the point where there is only one most economical voltage for each given rating. This condition has developed in the United States the growing practice for purchasers of generating equipment to specify that the generator and its transformer deliver a definite transmission or distribution voltage, and leave it up to the manufacturer to fix the generator voltage and offer the most economical combination. This arrangement places a definite incentive and responsibility on the manufacturer properly to co-ordinate the design and development of the generator in relation to rating and performance characteristics so that the most economical generating unit will be obtained. On this premise the most economical voltage for generator ratings up to

225,000 kva. would fall in the range from 13,800 to 22,000 volts. From the standpoint of the generator alone there are no design limitations which necessitate that the generator potential be higher than 22,000 volts.

Graded insulation for higher voltage windings

From the standpoint of generating station design and economics the disadvantages, limitations and additional cost associated with switching equipment, cables and station structures in handling large alternating currents emphasize the importance and need for building the larger capacity turbo-generators for higher voltages—i.e., 27,600 to 33,000 volts. In this country a number of turbo-generators have been built for potentials of 16,500 to 23,000 volts. However, there has been no marked increase in the magnitude of the generated voltage during the past five years. In Europe a number of turbo-generators have been built for direct generation at 33,000 volts.

In the case of generators wound for voltages appreciably higher than present standards there is a greater need for controlling and limiting the amount of corona present under normal operation and over-potential test conditions. It is known that corona has been present in the case of many of the older machines wound for standard voltages, but there has been no case where corona has damaged mica insulation and caused a winding failure. In the case of machines of modern design the corona from the surface of the buried part of the coil to the stator iron is completely eliminated by covering this portion of the coil with a semi-conducting material so that it is at the same electric potential as the stator iron.

The possibility of corona existing between the end turns and the stator iron and between end turns of adjacent phase groups can be eliminated by (a) applying graded resistance materials to the external surface of the coil ends and interconnecting the resistance circuits so that the potential drop across any air space will be well below its breakdown value, or by (b) providing semi-conducting potential equalizing and distributing surfaces at definite sections inside the coil insulation so that the air spaces will not be overstressed at any point. With these recent advances which have been made in analyzing and controlling the corona problem it is possible to build 33,000-volt generators with the assurance that no more corona will be present than is encountered on present machines wound for standard voltages.

Higher voltage, however, lowers kva.-voltage ratio

Generators wound for voltages appreciably higher than the present standards have a relatively low kva.-voltage ratio and thus are larger, longer and more costly than if built for standard voltages having more favorable kva.-voltage ratios. If the 183,333-kva., 13,800-volt generator previously mentioned were designed for 27,600 volts the effective length would be increased approximately 25 per cent, stator copper weight 8 per cent, stator winding insulation 114 per cent and the generator cost 25 to 30 per cent, on the basis of using the same amount of insulation on all coils. All of the high-voltage generators built in this country have had the same insulation on all of the coils, whereas in Europe the 33,000-volt generators have had the stator coil insulation graded in two or more steps in progressing from the neutral to the main terminal leads. With graded insulation the increase in weights, dimensions and costs should compare with an average for the grades of insulation used. If the stator winding of the 27,600-volt winding for the 183,333-kva. generator had two grades of insulation on the stator coils the effective length would be increased approximately 13 per cent, stator copper approximately 6 per cent, stator insulation approximately 60 per cent and generator cost approximately 15 per cent. From the standpoint of generator economics the use of graded insulation is a very attractive proposition.

There are several different types of stator winding which are suitable for graded insulation application. The type of winding shown in the figure uses the standard type of coils with rectangular cross-section for open slots. In each slot there are two coil sides, one insulated for full generator voltage and the other for one-half terminal voltage. The coil sides are placed alternately in the top and bottom of the slots for alternate slots. The respective coil sides of each insulation grade are connected in series and the leads brought out for two independent windings, one insulated for one-half and the other for full voltage. The two windings are connected in series, with the low-voltage winding located nearest the neutral, to develop full voltage. This type of winding introduces no new difficulties in assembly, coil end bracing, intercoil and wiring around frame connections and end turn insulation.

Protection against voltage surges

With generators wound for higher voltages and connected direct to transmission and distribution systems there is a need for providing protection against lightning and switching potential surges, where the conditions are such that the surge hazards exist. The generator winding must be protected against overvoltage to ground and overvoltage between turns due to steepness of surge wave front or to internal oscillation within the winding. During the past year the surge phenomena have been carefully investigated, surge tests made on actual machines and definite results obtained and conclusions reached as to the method of protection to use. Briefly, the most favorable, least expensive and reliable protective system is to apply a lightning arrester at a favorable location between the generator and the distribution system to limit the magnitude of the potential wave which can reach the generator winding, and thus limit the voltage stress to ground.

In cases where an insufficient length of underground cable (from the standpoint of condenser capacity) is used between the generator and the distribution system it will be necessary to install a static condenser at or near the terminals of the generator in order to absorb the energy of the incoming wave and decrease the steepness of its front. With sufficient static condenser capacity installed the slope of the incoming wave can be reduced so that the voltage stress between turns will not reach the breakdown value of the insulation between turns. The recommended protective equipment is based on the condition that the winding is star connected and the neutral point is grounded. If the winding is star connected with an ungrounded neutral or delta connected it will be necessary to provide additional equipment respectively at the neutral and midpoints of the winding.

Performance characteristics of stator windings with graded insulation differ from windings with uniform insulation only in regard to the over-potential tests and

protection against over-potential surges. In making the over-potential tests each of the two windings will have to be tested separately at a potential corresponding to its class of insulation. In order to protect the winding with the reduced amount of insulation against over-potential stress to ground additional protective equipment is required at the junction between the low and high potential windings. The actual cost of the additional protective equipment required by the high-voltage generator with graded insulation is relatively insignificant as compared to the reduction in the cost of the generator.

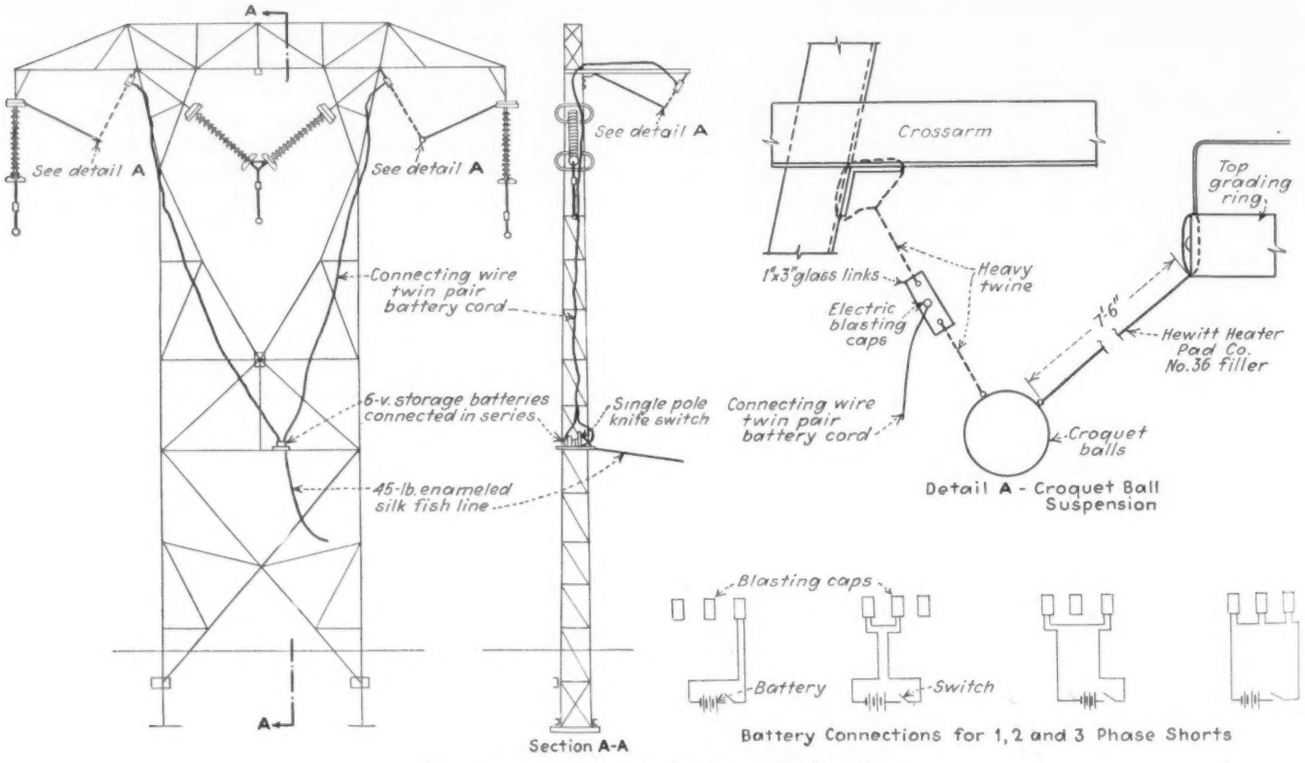
With the satisfactory operating record of 22,000 to 24,000-volt turbo-generators in service in this country and the added knowledge that has been gained on insulation materials, application and processes during the past few years it is our conclusion that 33,000-volt generators can be built with the assurance that they will render an equally reliable service record. This conclusion is based on the condition that such machines will be given the necessary protection against system and lightning surges. Generators with high-voltage windings of equal reliability can be built with graded insulation, provided additional protective equipment is installed at the junction between the low and high potential windings. From the standpoint of generator economics the use of graded insulation offers appreciable reduction in generator weights and costs. The use of graded insulation in the construction of high-voltage generators is recommended for serious consideration by purchasers of generating equipment.

▼ ▼ ▼

Shorting 220-Kv. Circuits for Field Tests

Croquet balls arranged to drop fuse wires across the upper and lower grading rings of 220-kv. suspension insulators proved the best method of short-circuiting the Fifteen-Mile Falls-Tewksbury line of the New England Power Association system in connection with extensive circuit breaker tests. It was impracticable to erect short bus structures at the test points with gang-operated disconnects on account of the risk to operators and excessive cost involved. Neither did closing line breakers on established grounds or the use of chain drags across phases fit the requirements, as simultaneous graphs had to be taken with 68 oscillographic elements located at four positions along the 126-mile line involved.

Details of the method used are illustrated. Above each fifteen-disk insulator a croquet ball was suspended from the crossarm and upper grading ring. Inserted in a length of heavy twine running from the ball to the crossarm was a glass link containing a blasting cap. The attachment to the upper grading ring was a piece of No. 36 filler wire used in the Hewitt heating pad, this wire being cut in 10-ft. lengths with knots 7 ft. 6 in. apart to provide uniform pendulum effect when the balls fell. The blasting cap was exploded on a given signal by closing a 600-volt knife switch mounted on the lower horizontal bracing of the tower, closing being effected by pulling on 400 ft. of enameled silk fish line from a wooden platform on the ground. The fish line was tested to 25 kv. per foot. Current to explode the cap was obtained from two 6-volt storage batteries placed on the lower tower brace near the switch.



Arrangement for test short on 220-kv. line.

Industrial Activity 42 per Cent Above Depression Minimum

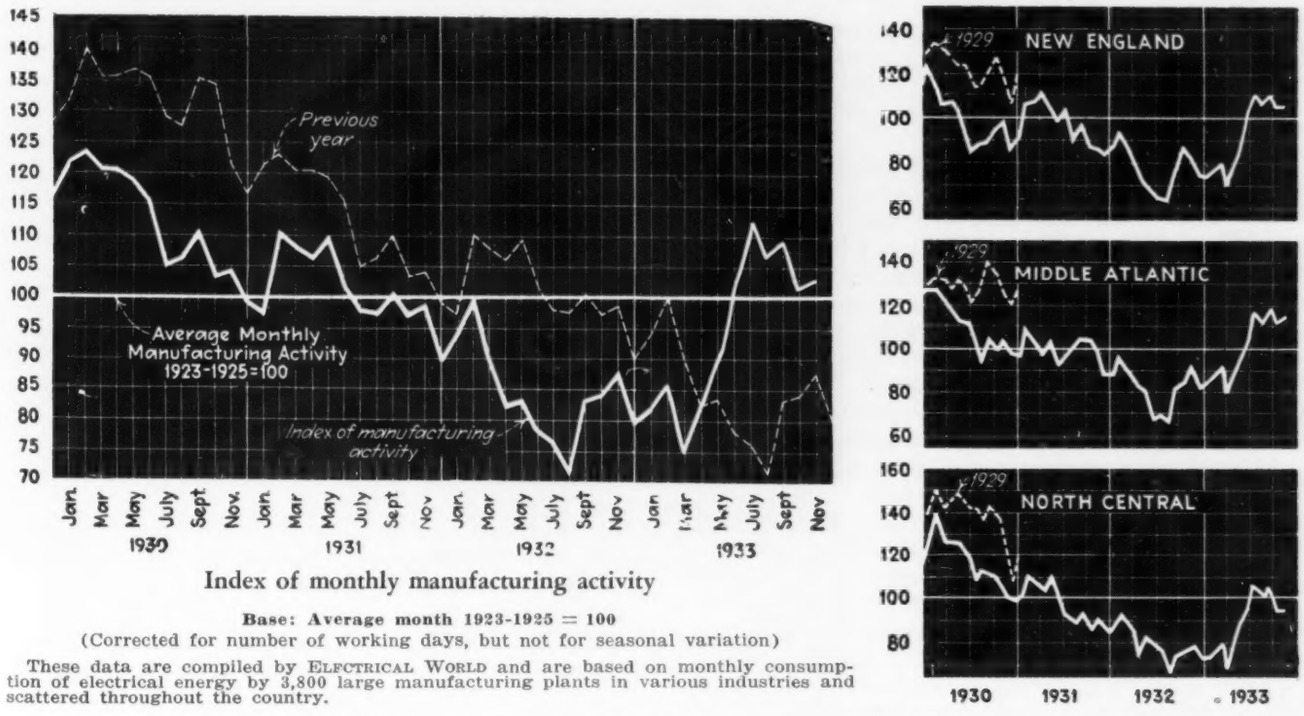
Industrial activity during November was maintained at the October average, according to reports of energy consumption in manufacturing plants of various types received by ELECTRICAL WORLD in its monthly survey. The remarkable acceleration of last spring and early summer culminated in July. The subsequent decrease of 9 per cent in the rate of activity, although indicating a recession from the year's peak, still leaves production 17 per cent greater than a year ago and 42 per cent above the depression minimum in 1932.

The virtual absence of change from October to November is to be observed not only in the weighted average but also in the separate industry groups, generally speaking, except on iron and steel.

In such small movement as did occur the line between consumer and producer goods has, in great measure, disappeared. Thus automobiles, textiles, leather, paper and rubber products show no significant movement; the rise in foods was nominal. A definite decline in iron and steel, for the second consecutive month, was balanced by gains in forest products and cement manufacture, the chief components of the stone-clay-glass group.

One feature brought out significantly by this series of index numbers—as by other gages of industrial conditions—is the relatively low level at which the group of metal industries is still operating. To a lesser degree this statement applies also to the stone, clay and glass group. While foods, chemicals, textiles and others are well above the 1923-25 average, and at least some of them have continued above that level throughout the past four years, iron and steel and metal-working are 23 per cent below the basic average. During much of the period they have been even lower. The favorable feature is the 35 per cent gain compared with operation a year ago.

The five geographical regions, like the country as a whole, had almost the same average activity in November as in October, excepting the West, for which figures are given on another page of this issue. Of important regional industries, New England metal-working and textiles have held firm for several months; the former 40 per cent higher than a year ago. Iron and steel in the Middle Atlantic and North Central regions, however, have been falling off from the maximum attained in July.



Index of monthly manufacturing activity

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.

	United States				New England				Middle Atlantic				North Central			
Industrial Groups	Nov. 1933	Oct., 1933	Sept., 1933	Nov., 1932	Nov. 1933	Oct., 1933	Sept., 1933	Nov., 1932	Nov. 1933	Oct., 1933	Sept., 1933	Nov., 1932	Nov. 1933	Oct., 1933	Sept., 1933	Nov., 1932
All Industry	**102.4**	**102.0***	**107.7**	**87.7**	**105.0**	**105.0**	**110.4**	**84.0**	**114.2**	**113.7**	**116.4**	**91.3**	**94.5**	**96.7***	**104.1**	**78.5**
Automobile (incl. parts and accessories)	54.3	52.1*	61.8	47.3	....	....	....	....	62.9	63.4	67.5	62.6	53.0	50.7*	60.8	46.5
Chemical products (incl. oil refining	163.0	160.0*	159.6	130.1	166.0	148.4*	188.5	140.5	176.8	172.8*	166.4	136.2	146.8	145.0	150.3	118.7
Food products	124.1	120.3	137.0	121.3	....	....	....	....	135.5	131.0*	150.9	130.0	119.0	115.2*	132.6	115.5
Iron and steel	72.0	83.5	89.3	57.5	135.7	140.0	149.0	98.0	67.8	72.5	76.3	46.8	71.1	88.1	95.6	61.3
Metal working	77.0	79.0	80.6	56.1	114.7	113.7	115.6	81.2	70.0	68.5*	69.5	53.3	73.5	81.0	84.0	53.0
Metals group	75.0	80.7	83.8	56.6	120.6	121.0	125.0	85.9	69.1	70.4	72.5	50.7	72.6	83.8	88.4	56.3
Leather products	90.8	91.2*	92.4	95.4	72.5	84.0*	81.7	80.7	108.6	104.2	110.2	120.3	89.2	81.5*	82.5	84.8
Forest products	107.1	100.6*	100.3	96.2	58.0	53.8*	59.8	43.2	75.2	71.5*	72.0	56.2	91.9	99.0*	102.4	84.3
Paper and pulp	133.5	134.2*	139.5	113.6	138.3	144.7	153.0	107.5	110.0	107.8	105.6	66.7	119.5	125.3	138.8	115.8
Rubber products	114.8	113.8	131.0	93.0	119.0	116.0	133.9	103.8	....	....	....	....	112.8	109.8	126.8	87.6
Shipbuilding	86.2	83.5*	83.5	84.0	....	....	....	....	....	....	....	....	....	....	....	....
Stone, clay and glass	91.2	85.8*	100.4	81.9	....	....	....	....	74.4	70.7*	81.3	61.7	114.4	106.2*	123.7	99.7
Textiles	108.5	107.4*	109.2	93.0	81.0	80.7	80.4	68.3	151.0	154.0	155.3	124.0	170.0	160.6*	145.0	124.5

*Revision.

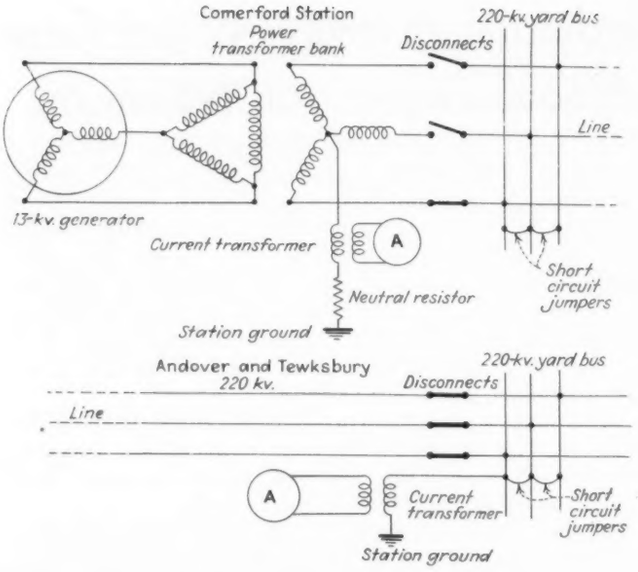
Studying Fault Currents in Transmission Telephony

In conjunction with the leasing of communication service from the New England Telephone & Telegraph Company for the 220-kv. transmission line of the New England Power Association system between Fifteen-Mile Falls (Comerford station) and Tewksbury, Mass., tests by artificial fault currents were made by the New England Telephone organization in co-operation with the power company. The power line has two three-phase circuits on separate steel towers on private right-of-way 126 miles long. There are two ground wires per tower. Continuous and reliable telephone facilities are permanently required between Comerford station, McIndoes station, Central New Hampshire switching station and Tewksbury substation. The power circuit patrol coverage requires about 23 spur lines bridged across the main telephone line. Each spur serves a private booth in the field with magneto calling facilities and special switching which leaves the spur open when not in use. The total length of telephone circuit is 375 miles, the base circuit between Tewksbury and Comerford being about 200 miles long. It generally parallels the power line, but is usually about 4 miles distant and is 16 miles away at Laconia.

The four permanent stations mentioned above average several miles distance from their telephone central offices. The system has grounded neutral connections, which tends to produce sharp rises in telephone ground potentials in case of power line faults, tending to operate the telephone protector equipment, ground the line and put it out of service. The object of the tests was to predetermine the ground potentials at key points on the telephone line under calculated fault currents in the power system. The power company provided an artificial ground current of about 50 amp. and measured it for the telephone engineers, the latter making the measurements of potential on the telephone circuit.

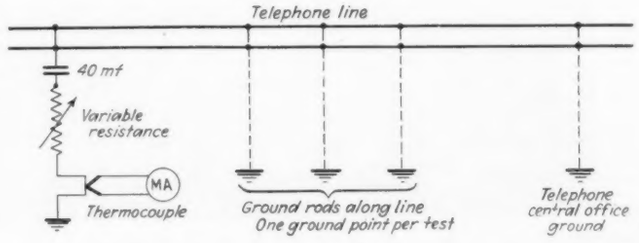
The power company computed the following maximum anticipated power line fault currents in system operation: At Comerford, 1,920 amp.; at Central New Hampshire (Andover), 1,570 amp.; Tewksbury, 4,800 amp. (at Tewksbury various 110-kv. circuits from other generating plants terminate). These maximum currents indicated possible potentials between the telephone station ground and the central office ground of 2,650 volts at Comerford, 1,550 volts at Central New Hampshire and 2,110 volts at Tewksbury, and revealed the necessity for special telephone protective apparatus at the four permanent stations.

The protection provided consisted essentially of isolating the telephone plant in the vicinity of generating, sub and switching stations from the rest of the communication facilities by using insulating transformers in all telephone lines on the lead serving the power or sub-station. These transformers were insulated for 25 kv. between windings. They are protected against lightning by special 3,000-volt arresters, where the adjacent telephone circuit is run in open wire. The transformers are mounted on H-frames in the telephone aerial. At Comerford they are in the open wire lead about 0.5 mile from the plant. At Tewksbury they are located at the junction of the aerial and underground telephone cable serving the station, and at Central New Hampshire and McIndoes they are at the junction of the entrance cable and main toll section passing these points. This type of protection prevents the power station ground potential from backing up through the telephone ground protectors and going to the central office ground through the carbons at that point. At Comerford the cable in the plant duct runs was extended through three sections of aerial cable before going into open wire as a precaution against lightning troubles occurring in the cable section of the duct.



Artificial ground current set-up provided by connecting an under-excited manually controlled generator to the power line through step-up transformers.

By leaving one set of disconnects closed and three phases of the 220-kv. yard bus short-circuited the three-phase wires of the test circuit were supplied in parallel through one phase of the transformer winding on the high side, while a single-phase charging current flowed to ground through the transformer neutral. The test circuit was completed by short-circuiting the three phase wires of the power line at the further end and grounding them to the station ground bus through a current transformer. In testing at Tewksbury the line was grounded at that point. Tests at Comerford and Andover were made simultaneously with the line grounded at Andover.



Ground potentials on the telephone circuit were measured while the artificial power ground current was about 50 amp.

The telephone testing equipment included a series circuit of condenser, resistance and thermocouple. The condenser was used to block out stray currents. The variable resistance provided a metering equipment of high impedance and regulated the current in the couple. From milliampere readings the rise of station ground potential over the ground at various grounding points was calculated.

Western Industry Rises, South Maintains Level

In contrast with the remainder of the country, the Western states show an appreciable increase in the average of industrial activity during November compared with October, as the figures in the accompanying table indicate. The regional gain of 6 per cent, in which nearly every group participated, brings the present level 19 per cent above last year for the corresponding month.

The weakest group continues to be that of the metal-working industries, combined with iron and steel, although it is maintaining the gradual upward movement which has thus far brought a rate of activity 80 per cent greater than a year ago. Further progress was made also in the lumber industry, 16 per cent ahead of last year's figures, and in the stone, clay and glass group, up 59 per cent. A vigorous rise in shipbuilding from October to November, 1932, was matched in part by a smaller increase this year. The net gain is 9 per cent.

As to the South, where the average is about on the October level and 7 per cent better than a year ago, interest centers particularly on the textile industry. Here operations increased rapidly during the spring, culminating in June and July, then receding to the present level, maintained four months.

The metal-working industries are now 17 per cent below the recent peak, though 34 per cent above November, 1932. Lumber also receded. Activity in iron and steel mills has resisted the downward movement; chemicals and paper advanced slightly.

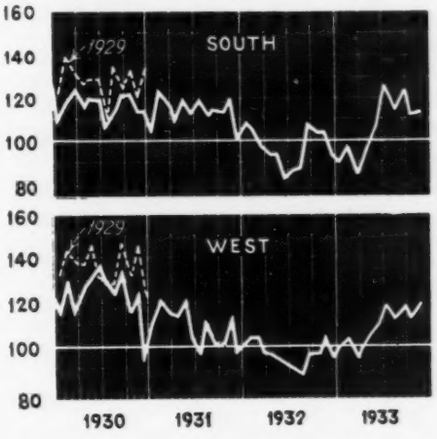
Index of monthly manufacturing activity, South and West

Base: Average month 1923-1925 = 100

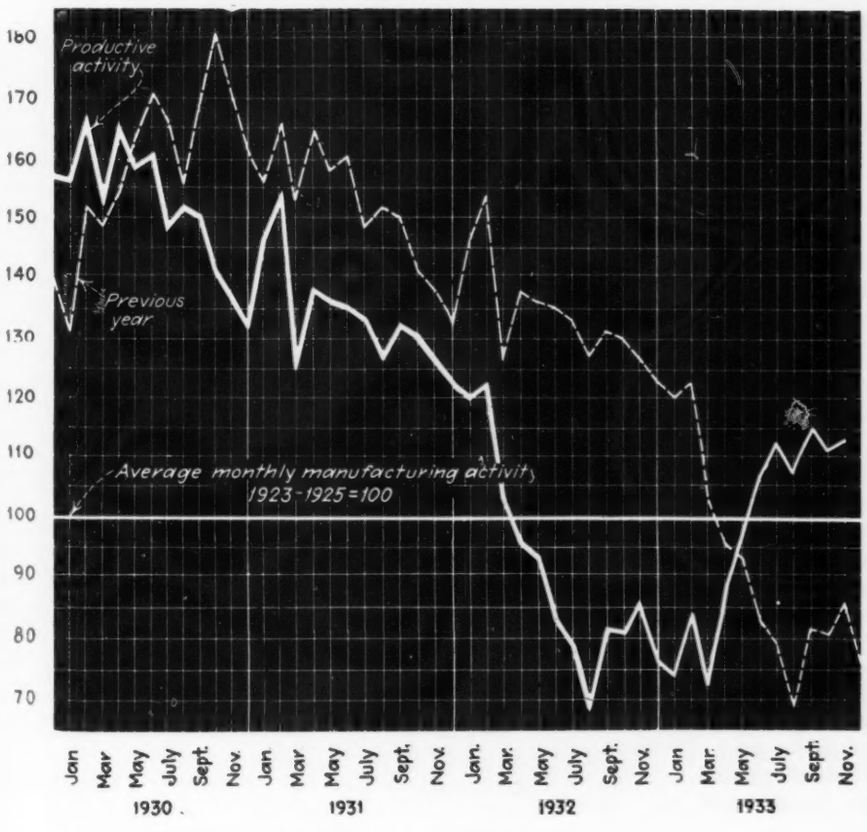
(Corrected for number of working days, but not for seasonal variation)

	South					West				
	Nov.,	Oct.,	Sept.,	Aug.,	Nov.,	Nov.,	Oct.,	Sept.,	Aug.,	Nov.,
Industrial Groups	1933	1933	1933	1933	1932	1933	1933	1933	1933	1932
All Industry	**111.4**	**112.0***	**121.3**	**114.8**	**104.4**	**120.2**	**113.3***	**112.8**	**111.7**	**101.3**
Chemicals	166.1	163.3	181.0	154.0	142.9	89.4	91.2	85.8	80.0	82.2
Food products	156.4	161.5*	174.8	156.5	138.7	118.9	111.3	119.3	115.8	113.0
Iron and steel	110.8	110.3*	114.8	147.8	71.7	....	....	....	....	....
Metal working	82.5	90.0	99.1	95.2	61.7	....	....	....	....	....
Metals group	98.8	101.3*	107.8	124.5	67.2	77.7	75.3	76.2	71.4	43.1
Lumber	46.3	50.8	53.5	51.6	51.4	168.0	155.3*	153.1	154.5	145.7
Paper and pulp	183.4	176.6*	186.7	167.8	157.5	147.2	145.4	138.2	134.0	141.7
Rubber products	69.5	102.8*	129.7	135.8	78.8	97.5	92.5	97.0	108.7	62.5
Shipbuilding	....	....	....	....	....	123.0	114.0*	113.0	117.2	113.0
Stone, clay and glass.	69.7	60.4*	110.8	89.3	143.4	123.3	118.2	119.6	116.0	77.7
Textiles	123.1	120.0	124.0	123.0	117.0	....	....	....	....	....

*Revision.



Electrical Manufacturing Trend Up



Continuing the fluctuations of the past few months, but apparently with a slight upward trend, activity in electrical manufacturing establishments during November exceeded that for the same month last year by 31 per cent. Reports of energy consumption in plants of this type, received by ELECTRICAL WORLD, show an unimportant increase over October, after adjustments for the number of working days.

Operations of the smaller companies are running closely parallel with those of the larger ones, the index numbers of the two groups differing by only a few per cent. The upward trend is shown by the 1933 quarterly averages of the index: successively 87.4, 100.1, 112.5, and for the past three months 113.2.

Monthly Index of Electrical Manufacturing Activity

Adjusted to 26 working days

Base: Average Month, 1923-1925

January	156.2	146.6	120.0	74.0
February ...	165.2	154.3	122.2	83.3
March	153.0	126.1	102.9	75.0
April	164.9	138.1	95.6	89.4
May	158.0	136.7	92.8	104.1
June	160.2	135.2	83.1	106.9
July	148.5	133.4	79.2	114.0
August	152.2	126.9	67.6	108.4
September ...	150.0	132.6	81.4	115.2
October	140.6	130.4	80.9	111.7
November ...	137.5	126.9	85.6	112.6
December ...	132.4	123.5	76.0	....

Room for Improvement in Machine-Tool Control

By D. K. FROST
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In this, the second of three articles* on applying electrical equipment to machine tools, the author discusses some of the major types of control available, their virtues and deficiencies. From his comments it appears that the tool designer has to make the best use possible of what the control manufacturers offer, and does not always have products that are best adapted to his needs.

With machine-tool designers recognizing more and more the advantages of replacing mechanical devices by electrical devices that offer greater ease of application and operation, closer co-operation is needed between them and electrical manufacturers. If the industrial electrical engineer grasps his opportunity he will make it his duty to apprise his production manager of developments in electrification of tools and will pass back to manufacturers experiences that will enable them to build tools which are simpler to maintain and operate.

AS AN ELEMENT in operation affecting safety, speed and quality of work the importance of electrical control and its arrangement cannot be overemphasized. The large part played by electrical control in machine-tool operation may be appreciated from the illustrations and captions accompanying this article. After determining the number, size and type of motors required on a machine tool, the next step in design should be to plan the type and location of control equipment and accessories. First in consideration are the mounting and inclosure of control devices.

Manufacturers now list their magnetic contactor controls so that the inclosing cases may be omitted if desired at a reduction in cost. In general, all contactors are arranged so that they can readily be built into machines. The ordinary inclosing cases furnished with standard panels are by no means dust-tight. We wish to quarrel with electrical manufacturers on this score. Where control devices are not protected from room dust and moisture the contact surfaces and moving parts are subject to corrosion and excessive wear. It is, by far, preferable fully to inclose control equipment, especially so where the air is contaminated with substances injurious to the life of the contact surfaces. It is only fair, however, to electrical manufacturers to state that they all offer dust-tight cases at an additional cost. This is a tacit admission that control is better off with such protection.

A tabulation of different sizes and makes of magnetic contactor control will establish the fact that they are not far apart in physical dimensions, size for size. Manufacturers have, I believe, now standardized magnetic contactors according to the ampere rating. It would be an excellent idea for them to be more closely standardized in size of base and mounting dimensions. Perhaps that is too much to expect, but there is no doubt that it would be of material benefit to the machine tool designer.

The rating of contactors in amperes indicates that the main contacts will carry that amount of current over any eight-hour period without seriously overheating. These ratings are 25, 50, 100, 150, 300 and 600 amp. Contactors also have a rating based on the amount of current in amperes which they will successfully make and break and still have a reasonably long life. This rating is not generally published. It is sufficient to say that this in general is 300 to 450 per cent of the contactor rating. It is better, however, if in doubt as to the correct size, to use the next larger size. For fast reversing or jogging service the next size larger should always be used. In extreme cases the second larger size would provide a better factor of safety. An exception to this may be made in the case of torque motors. As pointed out in the previous article,* such motors do not have a large inrush current compared with the running current. Also, the duty is generally intermittent and for short durations of time. This has been proved true by experience with control of torque motors over a considerable period of years.

Types of magnetic control

Magnetic contactor panels are available in several forms. The principal ones are:

1. Non-reversing for across-the-line starting.
   Non-reversing for resistance or auto-transformer starting with definite time or current-limiting relays.
2. Reversing.
   (a) Continuous automatic reversing.
   (b) Occasional reversing or for starting only in both directions.
   (c) For plugging.

Where used for reversing or plugging the contactors should be mechanically interlocked so that only one can be closed at a time. By using push buttons with normally closed upper contacts and normally open bottom contacts it is possible also to interlock the two contactors electrically. When reversing contactors are used for plugging there should be a switch mounted on the motor

*See ELECTRICAL WORLD, *December 2, 1933, page 717. An article on wiring machine tools for built-in electrical equipment will appear later.*

shaft to break the circuit when the motor comes to rest, otherwise the motor will reverse. Several types of these switches are available.

There are several ways to use magnetic contactor control for two-speed motors. The most convenient way is to use motors with separate windings and a contactor for each winding. Reversing contactors can also be used. In the case of a two-speed motor one contactor can be used for high speed in one direction and another contactor for low speed in the other direction. If two speeds are required in both directions two sets of reversing contactors are required. For four-speed motors reversing contactor control for all four speeds would be so large and unwieldy that it would be almost prohibitive. A much simpler scheme is to use a drum controller simply for speed setting, and then use a non-reversing or reversing contactor for starting and stopping at any speed for which the drum is set. For small size multi-speed motors it is cheaper and more satisfactory to use drum control for start, stop and speed control, either non-reversing or reversing with no contactor at all. This cannot be done with motors larger than 5 hp., and even at this size the drum must be well made and preferably furnished with arc barriers. This applies to either constant-horsepower or constant-torque motors.

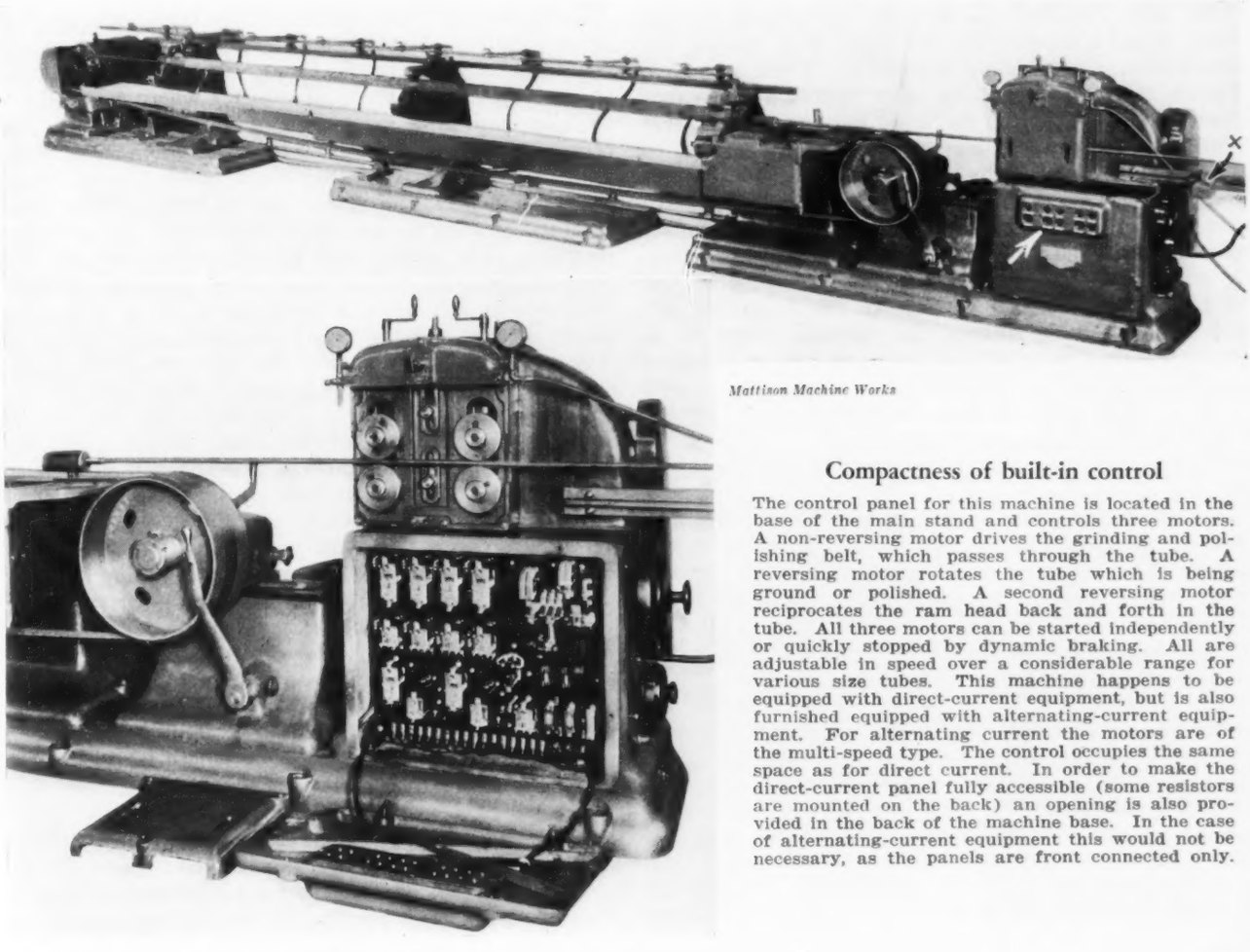
Drums now being offered for larger motors are furnished with special contacts which require a separate contactor to handle the current when changing from one speed to another, or when starting and stopping. This is rather complicated, especially for reversing service. Multi-speed motors have a severe kick-back when dropping from the highest to the slowest speed. The voltage generated in the slow-speed windings with the motor running at a higher speed may be as much as two to three times normal voltage. This means that on a 440-volt circuit this regenerative voltage may have an instantaneous value of 1,000 to 1,200 volts.

For use with magnetic control

Accessories for magnetic control may be listed as follows:

(a) Push buttons.
(b) Master switches (for reversing).
(c) Safety limit switches.
(d) Geared limit switches.
(e) Relays (thermal overload and load limiting) and various other types.
(f) Thermionic vacuum tubes and photo-electric cells.

The type and location of push buttons should receive the most careful consideration. The sturdiest type of push button available should be selected. It should have long guides, effective springs and suitable contacts. These qualities are found in the new type unit buttons now being offered by control manufacturers. The stop buttons should extend out further and be more readily accessible than the start buttons. In fact, the start buttons should be so recessed that accidental starting is impossible. A further precaution consists of a master toggle start-and-stop type button which opens up the entire control circuit when the stop button is pushed in.



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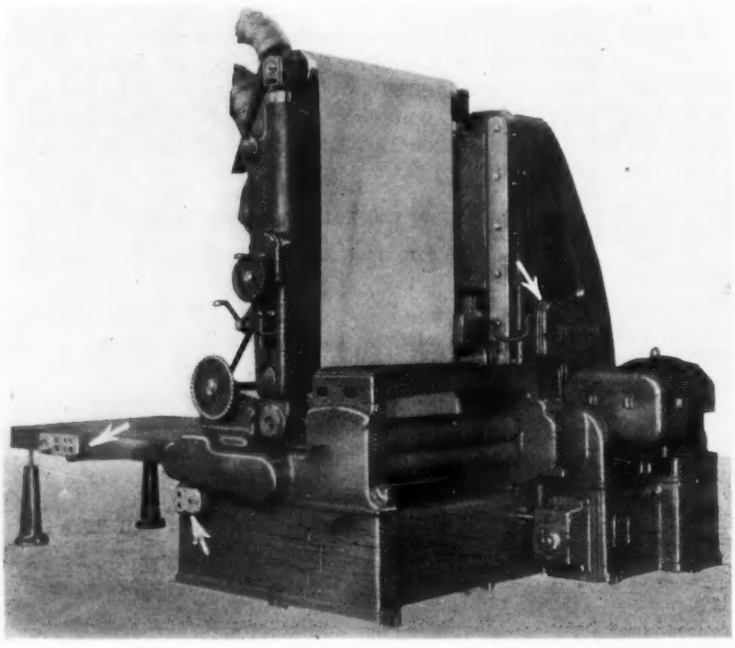
Compactness of built-in control

The control panel for this machine is located in the base of the main stand and controls three motors. A non-reversing motor drives the grinding and polishing belt, which passes through the tube. A reversing motor rotates the tube which is being ground or polished. A second reversing motor reciprocates the ram head back and forth in the tube. All three motors can be started independently or quickly stopped by dynamic braking. All are adjustable in speed over a considerable range for various size tubes. This machine happens to be equipped with direct-current equipment, but is also furnished equipped with alternating-current equipment. For alternating current the motors are of the multi-speed type. The control occupies the same space as for direct current. In order to make the direct-current panel fully accessible (some resistors are mounted on the back) an opening is also provided in the back of the machine base. In the case of alternating-current equipment this would not be necessary, as the panels are front connected only.



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Multiple panel control

Control equipment on this belt grinder is separated into three panels. One panel is in the base immediately under the main drive motor. This motor is constant speed, totally inclosed, fan-cooled, of the line-start type. An inclosed solenoid brake is used for stopping the motor. The grinding belt on this machine runs on rolls having anti-friction bearings. It would run several minutes if allowed to coast to rest. This motor is of the low starting torque type with about 125 per cent of full-load torque available for starting. It comes up to speed without any jerk and with a slow, steady pull which is especially easy on the grinding belt and also on the driving V-belts. The panel for the reversing feed motor and the 30-lb. torque reversing hoist motor is in the base under the feed motor. The control for the fourth motor, which is a continuous-duty, reversing-torque motor, is located in the main column under the cover on which the company nameplate is cast. This torque motor is controlled from photo-electric cells. The main object is to show how the control is located. It is well protected, but at the same time readily accessible. All panels are front connected and covers over the openings are as large as the panels. They are made dust-tight. It will be apparent that there is a minimum run of wires between the motors and control panels, being only a few feet in any case. The equipment on this machine is for alternating current.

This prevents accidental starting while the operator is working around dangerous parts of the machine.

The buttons used on the grinding machine illustrated are of the unit type with two normally closed and two normally open contacts. The buttons themselves are within larger molded cap buttons which have a close sliding fit on a surface an inch long, thus making the buttons as nearly dust-tight as possible. These caps have an inside clearance around the inner button, which makes it unnecessary to line up the inner buttons to any great degree of accuracy. It might seem rather unusual to pay so much attention to push-button stations. However, experience has proved that trouble with ordinary push buttons has been a major source of complaints. Some of the things which have happened would be amusing if they were not so serious in their consequences. As the holding and "make" circuits to the contactors are made through these buttons, the operator wants to be certain that the "make" circuit is always positive in action and that the holding circuit is just as reliable. Good contact in both cases is most important. Where there is any vibration present the holding circuit must be especially good to prevent unnecessary and annoying stopping of the machine.

A push-button unit is also used on the grinding machine mentioned as an automatic reversing master switch. The mounting is shown at "X" in the illustration. A steel plunger with a hardened roller takes the place of the molded part. It is only necessary to open the contacts to reverse the ram. A cam on the traveling shoe passing over the roller presses down the plunger and causes the reversal. After passing over the roller the button recloses, but that doesn't matter, as the only way to reverse the ram again is to open the contacts at the other end of the motion where a similar station is located. This is accomplished by using normally closed holding contacts on the reversing contactors themselves, together with an undervoltage relay. The ram is arranged so it will always start in the forward direction. The ram can be reversed or jogged at any time at the push-button station, regardless of the automatic reversals of the ram.

Safety limit switches are used on any motions which might cause damage by moving too far in any given direction. Here again we often use the unit push button or any of the various types of small safety limit switches. This depends on which offers the most convenient method of application. Geared limit switches may be used to control automatic repeated cycles. Instances of this control may be cited in the steel industry where geared limit switches control the movements of skip hoists. This cycle consists of a slow start, rapid acceleration at a given point, slow down at another given point, reverse, rapid acceleration back and stop. Geared limit switches have been successfully used on these applications for a number of years. The motors used are of considerable size and the velocities of travel are enormous. Loading machines with similar but more difficult cycles, such as varying points of slow and fast travel, are being constantly used. The opening and closing of the immense gates of the Panama Canal are handled by geared limit switches.

These applications are mentioned with the idea in mind that geared limit switches should find a fertile field in the machine tool industry. Consider a drilling or tapping head, or, in fact, any cutting tool which must go through any given cycle of operations. It is generally required that the heads carrying the cutters must move in fast, slow down, feed at the proper cutting rate, reverse, move out at fast traverse, and stop or repeat the cycle. Geared limit switches controlling torque motors through magnetic switches or direct from drum contacts on the limit switches themselves (where the current to be handled is not excessive) should afford all necessary features to obtain the desired results. If for any reason it is not convenient or advisable to gear the limiting contacts direct to the machine movement, a small synchronous motor would insure positive action.

Geared limit switches are available in many different forms. They can, as a rule, be changed to meet any desired duty cycles, with means for adjustment at intermediate points. Such applications would undoubtedly re-

quire considerable interchange of ideas and co-operation between electrical and machine designers. There is no apparent reason why the good results obtained with such devices in the steel and other industries should not also be possible in application to machine tools.

Ease of electric control application

A very obvious advantage of electrical equipment is the ease with which emergency and protective devices can be applied. Excessive loads, for instance, are reflected instantly by an increase in the motor current. Load relays, set by current values, will immediately trip out the running contactor and cause the motor to stop. They can also cause the feed motor to slow down, thus relieving the cutting tool if a predetermined load is exceeded. Undervoltage relays guard against accidental starting of equipment in case of voltage failure. The well-known thermal overload relays protect against sustained overloads, which might be injurious to the motor windings. There are many other forms of relays, such as reverse-phase, time-delay, instantaneous trip, etc., all of which are designed for specific purposes to safeguard against accidents to men and machines.

Solenoids, solenoid brakes, magnetic clutches and magnetic chucks are finding increased use. Plain solenoids are limited to motions of short travel not to exceed three inches, unless increased by link motions. The pull of a solenoid decreases rapidly as the length of air space between the iron core and the armature is increased. Conversely, the pull increases very rapidly as this gap is decreased. The action of a solenoid thus is very rapid and must usually be counteracted by springs to soften the hammer blow.

The solenoid principle has been used very successfully in solenoid brakes. These brakes are normally held open by the solenoid against the pull of strong springs. When the power lines to the motor are opened the circuit to the solenoid is also opened, allowing the brake to set and quickly to stop the motor. Brakes are rated in lb.ft. retarding torque. Full-torque brakes—that is, a brake with a rating equal to the full-load torque of the motor—will stop a motor quickly in case of emergency. One-half-torque brakes bring the motor to rest more smoothly and correspond in their retarding effect to the low-starting-torque motors in their accelerating effort. Both solenoids and solenoid brakes can be operated with either alternating- or direct-current coils with equally good results.

Magnetic clutches and chucks, on the other hand, require direct current. Since alternating current only is available in many plants this has prevented the widest use of these devices. It is now possible to obtain small amounts of direct-current supply for magnetic clutch and magnetic chuck operation by the use of electronic rectifying outfits.

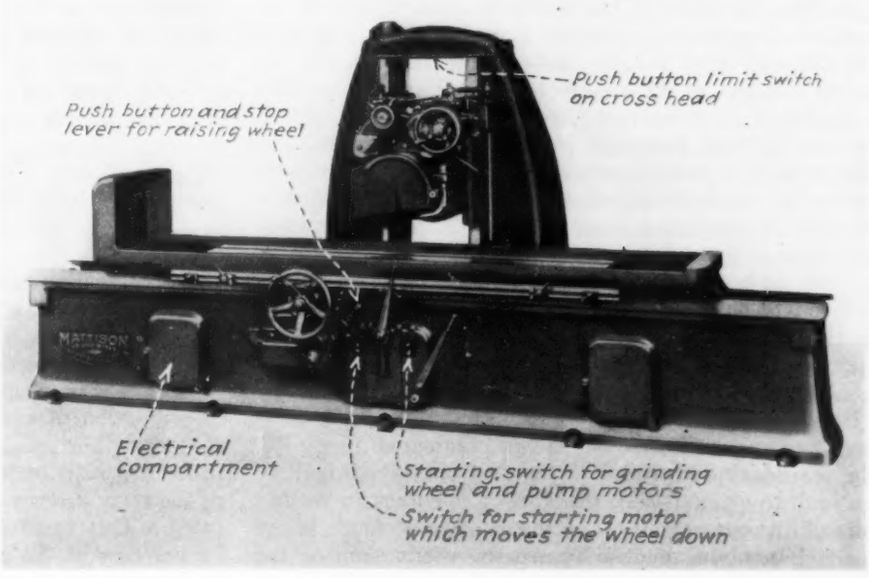
We have used a full-wave, two-tube rectifier on magnetic chucks with excellent results. Two magnetic chucks 20 × 36 in., requiring about 570 watts direct-current power, have been operating from a small-tube rectifier outfit for nearly two years with no trouble whatsoever. It is noticeable that, due to the constant voltage characteristic of the tubes, the gripping power of the chucks does not vary regardless of the load conditions. These rectifier outfits do not require any attention and are considerably cheaper than a small motor-generator set of equal capacity. An added feature is the fact that, even if one tube should fail, the remaining tube, giving one-half wave rectification, will pass sufficient energy to hold the work fast on the chuck. The chances are very remote that both tubes would fail at exactly the same time. These outfits can be equipped with a small relay connected in the circuit of the contactor controlling the main drive motor. In case of failure of voltage at the rectifying outfit this relay drops out and shuts down the machine. Interlocked in this way, a grinding machine is safeguarded against wheel breakage or accident due to the chuck letting go of the work while the cutting process is under way.

The dependability of these devices is measured by the average life in hours of the tubes. It has been fairly well established that an average life of 8,000 to 10,000 hours in actual operation may be expected. There are 8,760 hours in a year. If used constantly, then a year would be the life expectation. If used one-half the time two years would be the normal life. Our experience with the tubes that we have used has proved that these estimates are about right. Photo-electric tubes are also coming into considerable interest and use, but their applications on machine tools are so new that for obvious competitive reasons it is not possible to discuss them.

Magnetic clutches have not been used nearly as much

Push-button control application

A unit push button projects downward from the top cross member and prevents the wheel-head assembly from being carelessly run up too high. There is also a unit push button in the clutch handle. When the operator grasps the clutch handle to throw it from hand to power traverse his thumb depresses the button at the same time, starting the torque motor for raising the wheel. The motor runs only while the button is depressed.


Push button and stop lever for raising wheel
Push button limit switch on cross head
Electrical compartment
Starting switch for grinding wheel and pump motors
Switch for starting motor which moves the wheel down

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as their good qualities deserve. One reason has probably been because they operate only on direct current. Where a clutch is used most of the time for driving, with only infrequent unclutching, it is preferable to use the type that employs springs for holding the clutch in the driving position. This results in much smaller coils, rated on an intermittent basis, like a torque motor. The coil is only used at infrequent intervals to release the clutch. Most clutches, as now manufactured, use only light springs for holding the clutch open and continuous-duty coils with strong pull for holding the clutch plates in contact.

In general, where several motors are used on a machine, it is often not only advantageous but also necessary to interlock the functions of one motor with another or with several others. For instance, if the motor driving the spindle carrying the cutter should stop it would be disastrous in some cases to have the feed motor continue to run. It is often required that one motion be always started first. Generally speaking, it should be impossible to start a feeding operation before the spindle carrying the cutting tool is up to speed. There are, in fact, many machines which require a sequence of operation. This is easily accomplished by interlocking the control equipment. Where the control is centralized in one place no difficulty presents itself. Where the control panels are separated it means that a number of supplementary wires must be run from one panel to the other. It has been our experience that better results are possible with centralized control. With the control built into the machine a clean-cut, neat wiring job can be done. On the other hand, a very unsightly job is generally the result if standard control cabinets are hung on the machine or a nearby wall with the interlocking wires running between them. These interlocking wires are in addition to the wires between the control and the motors, and between the control panels and the push buttons, limit switches and other accessories.

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Zero-Sequence Current Transformers for Ground Protection

By J. W. GRAFF
Operating Engineering Department, Alabama Power Company

DURING recent years considerable study has been directed toward the development of reliable means of protecting medium-voltage distribution lines against ground faults. The problem is especially difficult when the line voltages are low and when the ground resistances encountered are high. Under these conditions all ordinary current relays fail. Potential devices can detect this type of trouble, but cannot discriminate between faults on various feeders, and for this reason they have not found very extensive application.

To meet this need a special three-phase current transformer was developed which gives definite indications of ground faults and is totally unaffected by other types of trouble. Essentially, the device is a refinement of the familiar Y-connected current transformers (Fig. 1). The ratios of three Y-connected current transformers are always dictated by the load to be carried and are usually such that a fault current of, say, 5 amp. (through a 460-ohm ground resistance on a 4,000-volt system) results in only a small fraction of an ampere in the secondary of the current transformers. This difficulty is overcome if the ratios are made 1:1 or even lower, but then there is the disadvantage that full line current must circulate in both primary and secondary. Such a transformer will be unduly large. Also, the characteristics of the three units to be used together must be very accurately matched as the relay must respond to a 0.5 amp. unbalance out of possibly several hundred.

However, if the three primaries are wound on a common core most of this trouble is eliminated (Fig. 2). The secondary does not carry current except when there is a fault to ground. The primaries alone must be wound for full line current. For any three-phase or single-phase load not involving neutral return the vector sum of the fluxes in the core is zero. In a sample transformer tested as much as 200 amp., single-phase load failed to give an indication in the secondary, whereas as little as 1 amp., line-to-ground, appeared as 1 amp. in the secondary.

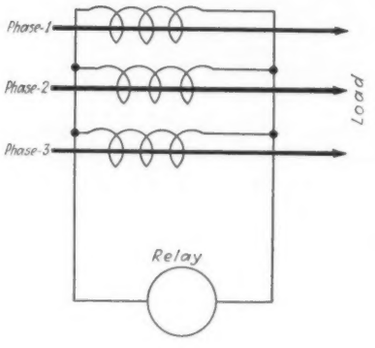
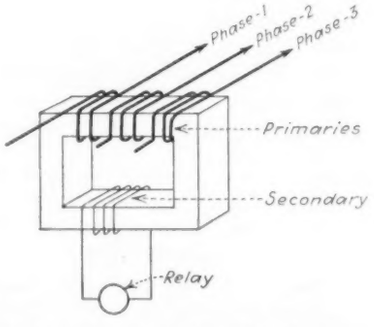


Fig. 1 — Ordinary zero-sequence connection of three individual current transformers

Ratios are always greater than unity.

Fig. 2 — Zero-sequence current transformers

Turn-ratio can be made less than unity without difficulty



An essential feature of this device is the saturating characteristic, whereby the relay is protected against excessive currents when the ground fault resistance is unusually low. This is obtained by a proper co-ordination of core cross-section, secondary turns and secondary burden. It is sometimes necessary to use a protective resistor in series with the relay as the burden of the relay drops very rapidly as the latter becomes saturated. This resistor should have an ohmic value about 75 per cent of the impedance of the relay.

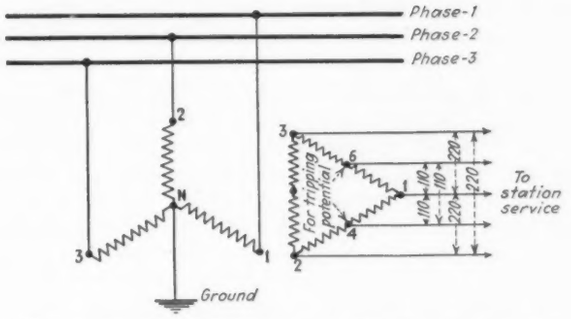


Fig. 3—Grounding bank used for station service and tripping potential

Points 4 and 6 give reliable 110-volt a.c. tripping potential even with solid single-phase or phase-to-ground short circuits.

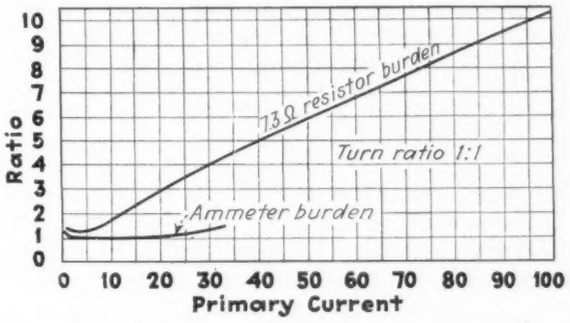


Fig. 4—Ratio characteristic of zero-sequence current transformer

Ordinarily it will be found that the usual low-energy current relays are quite satisfactory, but by the use of a d.c. D'Arsonval type of relay the current transformer can be made much smaller. This will prove an important advantage in some instances where a heavy load is to be carried.

Application of zero-sequence current transformers on grounded systems requires no additional equipment. However, when used on ungrounded 2,300 or 6,000-volt systems a small grounding bank, with or without current-limiting resistor, is necessary. The low-voltage delta secondary of this bank can be used to advantage for station service where required, and a connection as shown across the delta will provide a reliable source for potential tripping (Fig. 3).

Table I—Representative Ground Resistance of Arrester Grounds on Rural Line 25 Miles Long

Pole No.	Resistance (Ohms)	Pole No.	Resistance (Ohms)	Pole No.	Resistance (Ohms)
51	120	191	11.8	346	40
68	40	205	158	396	135
78	20	259	21.8	423	78
154	29	269	70	434	520
160	105	276	8	441	52
168	48	299	505	450	155
178	19.5				

Table II—Representative Ground Resistance of a Span of Wire Lying on Ground

Location	Resistance (Ohms)	Resistance of Driven Rod at Same Location (Ohms)
Gravel and rock	3,300	750
Sand	2,000	520
Red sand—clay	365	105
White clay	60	12.0
Sandy loam—weeds and brush on surface	1,100	135

A test installation in a 2,300-volt substation has indicated that this equipment will be satisfactory for protecting such feeders against grounds in event of a conductor failure. This equipment using a nominal 1:1 ratio of the current transformer trips successfully for ground faults up to 2,500 ohms in resistance. This sensitivity can easily be doubled by reducing the secondary turns to half their number and such a ratio will probably be standard for 2,300-volt service. Ground protection at this voltage involves adequate protective requirements and its success at this voltage indicates very easy application to voltages up to about 11 kv.

By reference to Tables I and II the reader may obtain some idea of the sensitivity required for a ground protective scheme. Table I shows the resistances of driven grounds along 25 miles of representative 11-kv. line. Thus, for a failure between high- and low-side windings of a transformer or from high side to ground, the minimum ground current to be expected on a 2,300-volt system will be about 2 amp. If the voltage were 11 kv., the current could be correspondingly higher. The fuses on the smaller transformers will blow at these values of current and sufficient time delay should be allowed at the substation to allow these to clear without interrupting service to the line. However, in event the fuse does not clear, the circuit breaker must be tripped.

Table II shows representative values of the ground resistance of spans of conductor lying on the ground in dry weather. To permit operation of the protective scheme under these conditions the current transformer ratio must be such as to allow the relay to operate down to a minimum of about ½ amp. on 2,300-volt systems and about 2 amp. on 11-kv. systems.

Value of Transformer Inspection

Consistent adherence to a simple inspection schedule is stated by W. G. Kelley, Commonwealth Edison Company, Chicago, to be one of the important reasons why distribution transformer failures on the company's system, as shown in the accompanying tabulation, have steadily decreased in the past five years. Even allowing for the decrease in load due to general conditions, it is to be noted that the decrease of failures was apparent in 1930 and depression was not widely felt until after that year.

The inspection schedule begins with the receipt of the transformer from the maker. After it is thoroughly looked over, the transformer is sealed and the seal remains on it when it goes out into service. If the transformer is taken down in the ordinary course of system operation—that is, not on account of trouble—if exterior examination shows it to be apparently O.K. and if the date on the seal shows it to have been in service for less than five years, then it is put into stock and returned to service when needed. But if the seal shows that the transformer has been working five years or more, then it is automatically routed to the shop, where the core is taken out and washed if sludge is observed in the oil and where it is given a double potential test. In effect, the inspection schedule amounts simply to carrying out a policy of testing, cleaning and overhauling all transformers that come off the line after five years of service.

One of the other contributing factors to the decrease

Commonwealth Edison Record of Distribution Transformer Failures

Only failures from overloads, which best reflect inspection policy, are set forth in detail. Approximately 36,000 transformers are on the system and of these nearly 6,000 are of the stud connection type.

	Overloads in Distribution System	Overloads on Single Customer Transformer	Total All Causes
1928	24	7	339
1929	16	12	321
1930	6	0	290
1931	0	1	228
1932	1	0	210

of transformer failures is the use of units with stud connections instead of leads trained out of the case which the company began to buy exclusively about five years ago and of which nearly 6,000 are now in service out of a total of about 36,000. Another factor is the improvement in lightning protection from interconnection of primary and secondary neutrals. A third factor is the closer attention to transformer loading given in the past few years. However, these other contributing factors may, in a sense, be grouped with inspection since they are expressions of maintenance policy, of which inspection must be the cornerstone.

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Competition from Diesel and Gas Engines

By F. E. KRUESI

President Northwestern Public Service Company, Grand Island, Neb.

Competition against central station power by Diesel and gas engines must be regarded as legitimate and worthy in any particular case until engineering analysis proves it not to be, just as the prisoner at the bar is assumed innocent until he is proved guilty. Too often the power salesman fails to show such openmindedness and he damages his case by display of prejudice.

Much business which has been lost to Diesel and gas engine competition has been in the cases of customers who required special investment in lines and transformers to serve them. This special investment, in turn, required a special rate or contract with high minimum or demand charges. Under present business conditions the consumption of such a customer is low, and he is consequently finding the charges of the utility company particularly irksome. The utilities have frequently been at fault in over-reaching themselves in their desire to get business and taking it on an unsound basis. Had the customer been required to make the special investment he could not so easily have kicked out from under the contract and provided his own source of supply.

We perhaps make the mistake of considering some business as being competitive when it really belongs to the other fellow. In many instances it could be more economically served by means of an isolated plant. There have been too many miles of transmission line built to serve loads which do not warrant the investment, and this fact might just as well be recognized by the utility companies. This applies as well to the serving of communities as to individual customers, and where engineering or financial mistakes of this kind have been made the utility company can hardly expect to hold the business.

The customer's power costs should be thoroughly and honestly studied. There is no object to be gained either in trying to fool the customer or yourself. If you get—or try to keep—business on too high a rate you are going to have a dissatisfied customer. The utility companies must bear in mind that their customers who are engaged in manufacturing processes in which power bills are large items also have to meet competition. We probably all know of instances where the utility has told a large dissatisfied customer that it could not lower its rate, only to find, after the customer had gone ahead in a serious way to provide his own source of supply, that it could have lowered its rate to meet the competition and would have much preferred to do so rather than lose the business.

As utility operators, we are frequently abusive of the engine salesman, but we are not always consistent in this respect. There have been many—and there still are some—instances where private utility companies are operating Diesel engines, which companies are connected with or adjacent to large power systems. The large power company has been very reluctant to reduce the contract rate to such smaller companies to the point which made it uneconomical for the small company to operate the Diesel engines. It is not particularly convincing to manufacturers or municipalities to be told that a Diesel engine is no good, when they see power companies themselves using them to the extent and way in which they do.

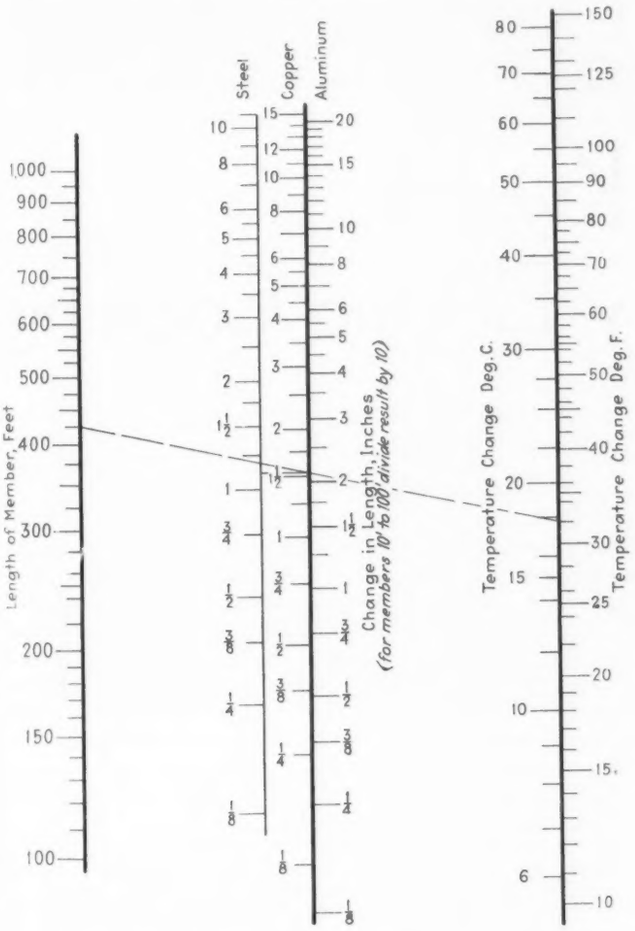
There is no use in minimizing the competition which may be expected from the Diesel engine. It can be met successfully wherever the Diesel engine is not the economical unit for the particular situation, if the right rate is made. There is business to be had even in times like the present and on a profitable basis if it is really wanted. We have recently obtained some highly desirable additional business from some of our present customers at rates materially less for the additional business than the customer was under contract to pay. There is other business which is now being held by Diesel engines which we are out to get, knowing full well that we cannot get it excepting as we will make a rate which will save our customer something over his actual present Diesel engine operating expenses.

It is only in small power installations that the gasoline engine enters into competition with purchased energy. Converted engines, salvaged from old automobiles, are sold on the representation that considerable money can be saved over the use of an electric motor, and, on the basis of fuel cost only, this sometimes convinces the customer. Possibly the best method of combating activities of salesmen selling such engines is to point out to the customer the comparison between using the engine as a source of factory power and using it as a driving motor in an automobile. When the customer is shown that a year's operation in a plant, driving some sort of equipment and operating approximately at full load, is equivalent to the driving of 150,000 to 200,000 miles in an automobile with the motor operating at something less than full load much of the time, it will be apparent to him that he is going to have a sizable annual repair bill. Safety first should also be stressed, particularly if such engines be operated without governors. These are largely a product of the depression and this competition is perhaps only temporary.

Rapid Solution for Bus-Expansion Problem

By W. B. MORTON
Philadelphia Electric Company

Design of heavy rigid buses must include a consideration of the change in length due to temperature changes in both the bus itself and in the supporting structure. The rates of expansion for copper and aluminum are considerably greater than those for structural steel and all structure materials, such as concrete, brickwork and various types of dressed stone. Heating of buses under load causes an additional expansion, so that under ordinary conditions expansion joints are required at frequent intervals to prevent accumulation of excessive stresses in the insulator supports. The customary practice is to inclose the bus with a rigid clamp at intervals and allow the conductor to pass through intermediate supports provided for a slip fit, the resulting movement being taken up in suitable expansion joints and fittings.



Expansion of steel, copper and aluminum with different temperature changes

Note that the scale for steel is read *opposite* the copper-aluminum scale, *not* where the line between the length and temperature scales crosses the steel scale.

For practical purposes the change in length of any material due to a change in temperature may be expressed by the formula:

$$x = Cl_o\ (t_1 - t_o)$$

in which:

x = the change in length—an increase or decrease as t_1 is greater or less than t_o.
C = coefficient of linear expansion.
l_o = length at initial temperature, t_o.
t_o = initial temperature.
t_1 = final temperature.
Also $l_1 = l_o + x$ = length at final temperature t_1.

The average values of C for the more common materials are:

	Coefficients of Linear Expansion	
	Per Deg. F.	Per Deg. C.
Aluminum	0.0000128	0.0000231
Copper	0.00000928	0.0000168
Structural (medium) steel	0.0000067	0.0000120
Brickwork	0.0000031	0.0000055
Concrete	0.0000079	0.0000143
Slate	0.0000058	0.0000104

The expansion of steel, copper and aluminum conductors may be quickly determined from the nomograph. In the solution illustrated, with a 425-ft. member and a temperature rise of 32 deg. F., the expansion is for steel $1\frac{1}{8}$ in., for copper $1\frac{9}{16}$ in. and for aluminum $2\frac{1}{8}$ in. These correspond with computed values of $1\frac{3}{32}$ in., $1\frac{1}{2}$ in. and $2\frac{3}{32}$ in. respectively.

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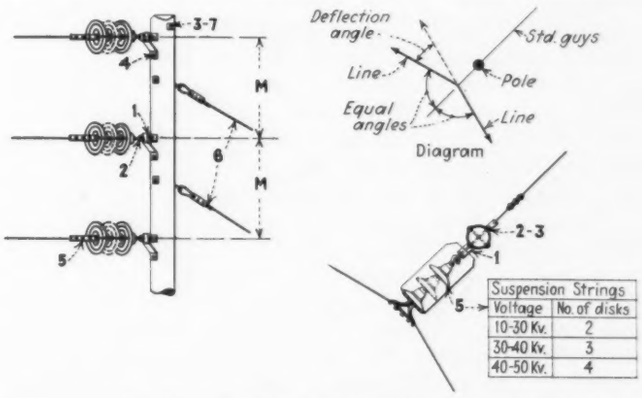
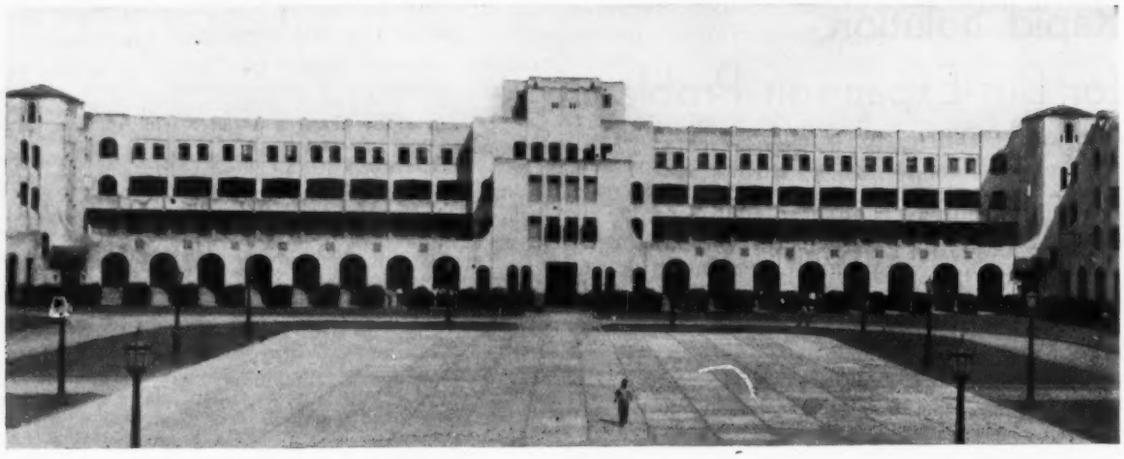
New England Power Angle-Pole Standard

The New England Power Engineering & Service Corporation's standard design for transmission angle poles with vertical arrangement of conductors in 10-kv. to 50-kv. construction is shown herewith. The design utilizes standard suspension strings, with from two to four disks, two guys per pole, and is applicable to deflection angles of 15 to 90 deg. for No. 2/0 B&S conductor and above. The distance "M" between insulator axes equals the normal spacing between phase wires unless a greater spacing is required. Poles are raked from 2 to 3 ft. at the top in the direction of the guys. Anchor guys are preferred to head guys when feasible. Where the right of way permits, two separate poles are used for turning two circuits. Material includes: (1) corner brackets; (2) through-bolts; (3) square washers; $\frac{13}{16}$x$2\frac{1}{4}$ in.; (4) lag screws, $\frac{1}{2}$x4 in.; (5) standard suspension strings; (6) guys; (7) $\frac{5}{8}$-in. through-bolt at pole top.



Suspension Strings	
Voltage	No. of disks
10-30 Kv.	2
30-40 Kv.	3
40-50 Kv.	4



Three meals cooked for one cent's worth of electricity in this model prison

Eight Meals per Kw.-Hr. by Electric Cooking

By P. W. RAYMER
General Commercial Superintendent
Porto Rico Railway, Light & Power Company
San Juan, P. R.

IT TOOK tenacity and careful figuring to induce the Porto Rican government to install electric cooking in the new San Juan prison. Estimates had to be pared several times, but now that results are available they prove to exceed the estimates in all particulars as to economy. For the full year the actual kilowatt-hour consumption per meal has averaged 0.129, with cost at $0.00303.

Until recently the government of Porto Rico has been using an old Spanish prison built under the walls of San Juan more than one hundred years ago, the prisoners living in very crowded quarters, the cooking of meals being done in huge vessels over open fires where wood was used for fuel. Baking was also done in old Spanish stone and cement ovens which were also fired with wood.

The government recognized the necessity of building a new and modern prison and commenced work in 1927 on a huge structure outside of San Juan. About three years was required to complete the building, which contains 332 cells and twelve dormitories to furnish quarters for 1,250 prisoners. The building also contains a general hospital, a tubercular hospital, infirmary, dental office, tailoring shop, plumbing shop, shoe shop, broom factory, carpenter shop, bake shop and elemental schoolrooms, besides the huge kitchen necessary to serve the men.

Government sold on economy basis

When we approached the Department of Justice to suggest complete electrification, we were naturally told that the government could not afford to install equipment which would be so expensive to operate. Nevertheless we spent months getting data on diets, power requirements, lighting consumption, equipment operating data, and at last submitted a report that we considered really attractive, but which was not quite attractive enough to suit the Insular officials concerned. We again made a new study of every possible item that could be considered, including the use of special cooking equipment instead of the usual hotel type ranges, and were able to present a much lower estimate of cost of operation. Finally the Attorney-General (later Governor of Porto Rico), James R. Beverley, was convinced of the advisability of complete electrification on account of both cleanliness and economy. As a result, the following cooking equipment was installed:

Seven 20-gal., 8-kw. cereal boilers.
Four 60-gal., 12-kw. stock kettles.
Three double-deck, 60-loaf, 18-kw. bakeovens.
Two hotel type ranges, 24 kw. each.
One 100-gal., 6-kw. water heater.
One 60-gal., 4-kw. water heater.

In addition to this cooking equipment, all of the shops were equipped with individual motor-drive modern machines for wood working, metal working, broom making, laundry, etc. All sterilization equipment in the hospital, operating room, dental office, etc., was also electric.

The rate under which the institution is served is as follows:

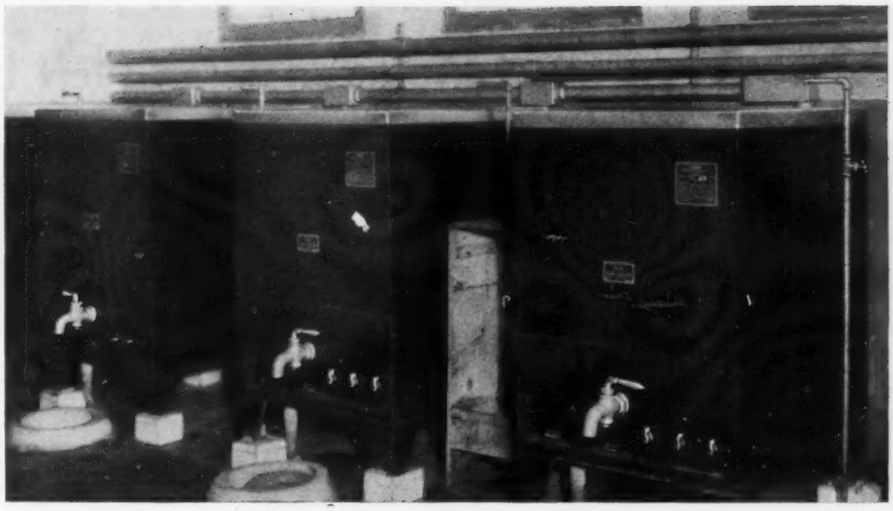
$2 per kva. demand per month.
3 cents per kilowatt-hr. first 50 hours use of demand.
1½ cents per kilowatt-hr. for the excess.

A bank of three 50-kva. transformers was installed to serve the institution, which has a total connected load, including lighting, of 380 kw. Power is metered on high-tension side of the transformer bank, and since the kitchen is the largest single user of power, the graphic demand meter was installed where it would be handy for the head cook to see at all times.

A careful program was worked out for the various cooking operations so the maximum demand would be kept as low as possible. The supper hour is set so that all cooking operations will be over before dusk so the lighting load will not coincide with the cooking load. Since the lighting demand is lower than the cooking demand, the baking of 1,000 loaves of bread is done each evening after the shops and kitchen are closed.

The following figures comparing the estimates made prior to the installation, with actual results obtained a year later, are interesting:

Estimated total cooking consumption per month, kw.-hr.	15,660
Actual total cooking consumption per month, kw.-hr.	11,720
Estimated cooking consumption per meal, kw.-hr.	0.148
Actual cooking consumption per meal, kw.-hr.	0.129
Estimated cost per kw.-hr. for all purposes	0.0246
Actual cost per kw.-hr. for all purposes	0.0235
Estimated cost per meal for cooking	$0.0036408
Actual cost per meal for cooking	0.0030315
Estimated total monthly bill	$597.01
Actual bill for July, 1933	456.00

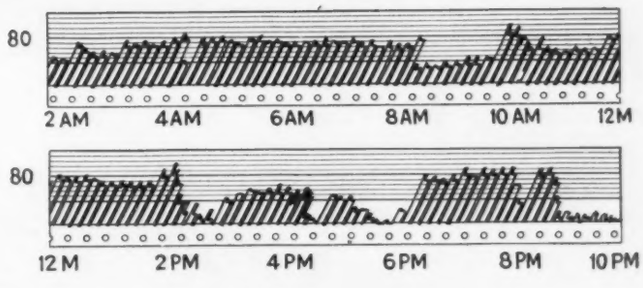


Coffee, beans and potatoes cooked electrically in four 60-gal. stock kettles

Rice cooked in seven insulated double-boilers of 20-gallon capacity

Demand kept within close limits

Staggered scheduling of cooking, baking, power and light uses along with heat-conserving appliances keep demand costs down.



Appliances designed to fit diet

We believe that the success in obtaining this business was due to the study made of the usual prison diet. A typical day's diet is as follows: Breakfast, milk, bread, coffee; lunch, bread, white rice, stewed red beans; supper, bread, white rice, stewed white beans, beef stewed with potatoes.

The cooking of these foods in the usual way could be done only with a terrific waste of heat and the electrical input for the cooking equipment could not be satisfactorily controlled to keep the maximum demand within reason. In looking over this diet, we decided that the coffee, white beans, red beans and potatoes could be cooked in large stock kettles which are well insulated, and which when loaded and heated almost to the boiling point will retain that heat with very little additional power for hours. The cereal boilers used for cooking the rice are like the so-called double boilers used in the home, the vessel containing the rice being placed in a larger vessel of boiling water. The preheating of the water for beans and stews in the stock kettles and of the water in the cereal boilers is done at a fast rate while breakfast is being served, and these units are then turned to $\frac{1}{2}$- or $\frac{1}{4}$-heat when the shops commence operating and require power. Due to the high efficiency of these units on account of insulation and direct heat application, the food is thoroughly cooked with the minimum application of heat.

Daylight Effect Produced With New Lighting Unit

Daylight lighting of show windows

Obtained by combining the line spectrum of a blue, high-intensity gaseous tube with the continuous spectrum of electric lights. The soft quality of the light is apparent even in this illustration.

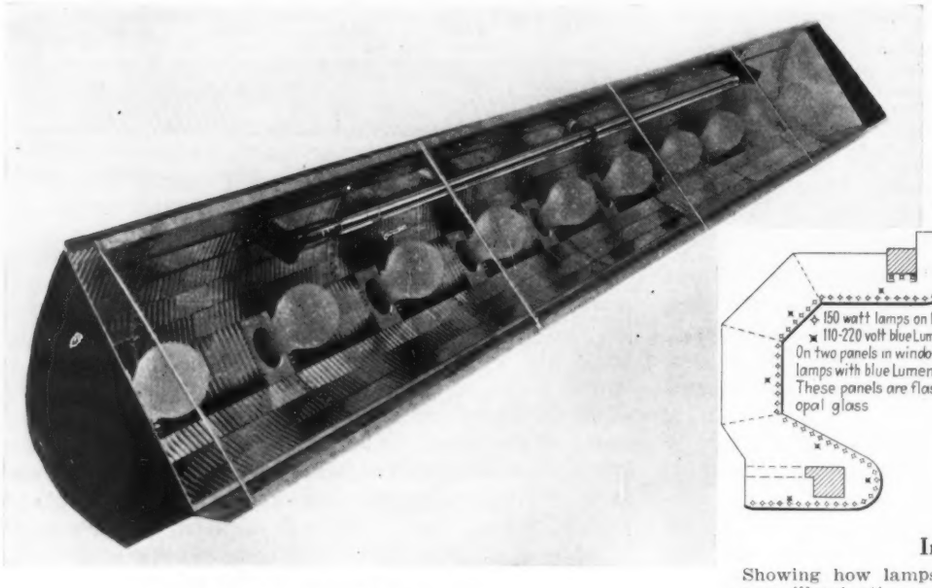
By R. M. MAXWELL

Electrical Products Corporation of California, Los Angeles

To display the natural colors of apparel and other merchandise used out of doors to the best advantage, an extremely close approximation to natural daylight is desirable in a window or showcase lighting installation. At Desmond's, one of Los Angeles' leading clothiers, a new combination lighting unit has been used to advantage in a window lighting installation to produce a soft daylight quality of light without the visual impression of high-intensity illumination usually required for this type of service.

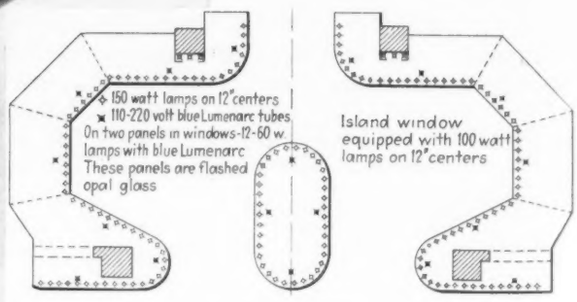
Natural light is a combination of sunlight which is predominantly red and skylight which is predominantly blue. Light from the conventional electric lamp contains a certain portion of the spectrum which produces a red-orange light. By combining this characteristic with the proper blending of blue light, a close approximation of natural daylight can be obtained. To supply a practical and economical source of blue light the Electrical Products Corporation of California experimented with gaseous tubes and succeeded in producing a hot-cathode, high-intensity, relatively high-current gaseous tube light source which would operate at the normal lighting voltages of 110 or 220 volts. The new product was patented under the name of "Lumenarc."

In the Lumenarc light source, which can be obtained



Combination lighting unit

This unit is designed for window lighting and mounts ten inside frosted lamps and a section of hot-cathode gaseous tubing in front of a mirrored reflector. Both the lamps and tube operate from the conventional 110/220-volt circuit.


150 watt lamps on 12" centers
110-220 volt blue Lumenarc tubes
On two panels in windows-12-60 w. lamps with blue Lumenarc
These panels are flashed opal glass
Island window equipped with 100 watt lamps on 12" centers

Installation layout

Showing how lamps and tubes are combined to obtain even illumination and high intensities without sacrificing the soft natural quality of the light.

in red, blue or green, a relatively high current arc discharge takes place between two hot cathodes at either end of the tube. The increased intensity, made possible by the hot-cathode construction, increases the candlepower per unit length of tube to a point where it becomes a practical supplementary light source for many lighting problems. Tubing is constructed of "Pyrex" glass in diameters from 18 to 25 mm., according to the intensity of light required. A 3-ft. length will operate satisfactorily on 110 volts a.c. at current values ranging from ½ to 2 amp., depending upon the type of gas in the tube. Tube can be obtained in 3-, 6- or 12-ft. lengths and can be bent to suit the requirements of the installation.

In the Desmond installation, the first of its type, the lighting unit consists of mirrored reflectors in which 150-watt, inside-frosted lamps are mounted on 12-in. centers around the window. Blue Lumenarc tubes are placed in each section to obtain the best distribution and light balance, the tubes varying in length from 3 to 7 ft., and arranged in both straight and curved sections. Units are recessed in the wall and the face covered by louvers of flashed opal glass set on edge and spaced 1 in. apart, a type of construction giving a smart, modern appearance to the finished product. The accompanying sketch of the lighting layout illustrates the arrangements of the units.

With this combination of 150-watt lamps on 12-in. centers and high-intensity gaseous-tube units, a uniform intensity of 200 foot-candles was obtained with 200 watts per lineal foot of window. Due to the clear white light developed, the windows appear to have considerably more light in them than is actually the case, the net result being adequate and economical illumination which displays merchandise more attractively by enhancing the beauty of its natural colors.

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READERS' FORUM

Contractors Invite Co-operation

To the Editor of the ELECTRICAL WORLD:

The November 18 issue of ELECTRICAL WORLD contains several matters of interest to the electrical contractor. I refer to Geo. Welman's article, "The Inspector Looks at the Contractor," also L. W. W. Morrow's editorial "What of the Contractor?" and his article "Sales—More Volume and More Profit." All of these are related and so excellent they are worthy of recognition and comment.

It is significant that Mr. Welman says: "The contractor is closer to the user of electrical current than any other branch of the electrical industry" and that "the industry is crying for some one to educate the user of electric current." Representatives of each branch of the industry have made similar statements, and Mr. Morrow, in his article, apparently recognizes the facts.

As Mr. Welman says, "the contractor has a wonderful opportunity," and Mr. Morrow points to this same opportunity by advocating the organization of the local sales outlets in the interest of getting "more volume and more profits." However, Mr. Morrow goes further and rightly concludes that "this is a joint job, and a joint responsibility, and a joint opportunity."

"Now what of the contractor?" as covered by Mr. Morrow's editorial. "Will the contractor take advantage of the opportunity offered?" as Mr. Welman so aptly asks. Both gentlemen recognize that the contractor cannot respond single-handed—he needs the co-operation of other branches of the industry. It is apparent, also, that both writers realize that the other branches of the industry need the contractor. Good salesmanship has always recognized the value of local and personal friendships.

Mr. Welman feels "sure that all branches will reciprocate," and Mr. Morrow shows how the other branches will have to reciprocate in order to make their co-operation effective.

The contractor recognizes only too well what both gentlemen have said, but he understands, also, that before anything can be done locally there has to be better and more practical understanding nationally. The contractor is not so depressed or void of thinking as Mr. Welman seems to believe. Witness the invitation that the N.E.C.A. has just extended to the N.E.M.A. and the N.E.W.A. for a conference to discuss the development of better distribution relationships and recognition of the functions and services of each branch of the industry. This is putting into effect an idea suggested by *Electrical West* many months ago and reiterated in ELECTRICAL WORLD, July 15. *Electrical West* said "the electrical industry needs a master code, defining the relationship of one branch to the other, and correlating the whole industry into a hard-driving commercial unit." ELECTRICAL WORLD said: "To rectify conditions it will be necessary to state the channels of sale for each product, the margins, the prices and the field of activity for manufacturer, wholesaler and retailer. It is direct selling, by-passing of wholesalers and retailers and lack of knowledge of costs of selling that create chaos in the electrical industry."

Therefore, the real question is, will the other branches of the industry arise to their opportunity? Particularly, will the manufacturers put their selfish ambitions in the background for their own good and the good of the industry?

It might be worth while, and certainly it would be timely, for Mr. Morrow to say something about this movement being started by the N.E.C.A. The degree with which the manufacturers respond to this movement will indicate whether or not they really want more volume and if they are willing to permit other branches of the industry to share in the profits in order to get the volume.

The time has come when the manufacturers and utilities can no longer "dominate the situation." All over the country the utilities have been "on the spot," so to speak, and they need the co-operation of the local sales outlets. If the manufacturers have the brains they like every one to think they have, they will do something about the matter without further delay and before they suffer some undesirable public criticism.

Mr. Morrow is right, "these local sales outlets have not asserted themselves" and "should demand what is needed from the manufacturers and wholesalers to do a

profitable business." Now we are nationally asserting ourselves and demanding recognition. We are going to have the national fundamentals put in order or the industry is going to see a wave of militancy and revolt take hold of the local sales outlets and contractors which won't help the manufacturers', wholesalers' and utilities' volume and profits.

The industry may not realize it, but it is a fact that the contractors and local sales outlets have been avoiding the sale of new equipment for more than a year. The industry does not seem to realize that the contractor and local sales outlets have a limited amount of time with each customer and necessity demands that the contractor make the best possible use of this time. He, therefore, employs it to sell the most profitable items and services he has to offer.

Local retailers and contractors owe no loyalty to the manufacturers, who stubbornly refuse to provide adequate margins and want the right to carry on all sorts of pernicious practices. The retailers and contractors are not going to waste any more time trying to "educate" this selfish, stubborn, unyielding crowd. We are going to look out for ourselves. There are many ways to make money and a living besides selling the products of the electrical manufacturer. Are there not numerous examples of contractors turning to non-electrical specialties, to second-hand business, manufacturing, jobbing, plumbing, steamfitting, heating and ventilating, etc.? What does all this mean but an outright revolt and a loss to the industry.

Now and then we see some merchant, not familiar with the ways of the electrical industry, make a big start to do things, selling electrical products. How long does it last? Just as soon as he finds out how our industry operates and gets on to all the "propaganda" and "bunk" he either turns to the sub-standard articles or quits altogether. The few department stores and manufacturer-owned appliance stores which do any kind of a selling job have the connections, the buying power and the shrewdness to buy at wholesaler's cost. This gives them the spread of two margins to work on.

I should think the utilities would take a greater interest in this situation than they have shown. Would they not gain the everlasting good will of the local people if they put the weight of their support behind the movement of the N.E.C.A.? Would they not find, as some of the manufacturers admitted to Mr. Morrow, that more goods would be sold and more load added to their lines when there are adequate margins provided for the retailer and contractor?

Even the manufacturers who are the worst offenders know that it is profits that are of greatest interest and make people act. They set their prices to give themselves plenty of profit and they advertise to the consumer the profitableness of doing things the electrical way. If they can sell devices and take care of themselves so well, why do they confuse the issue when it comes to providing an incentive for the contractor and retailer?

Sometimes I wonder if the manufacturers haven't been spoiled by the utilities lending their aid in promoting sales of unprofitable articles, based on the idea that they can get their returns from the current sold. If the utilities withdrew this sort of support the manufacturers would not find their row so soft.

As Mr. Morrow so well points out, it is in error to "assume that low-priced products will sell of themselves." It is also an error to think that cheap sales staffs can do the job. We must get over this peculiar form of cheap complex which the manufacturers have, wherein they justify their expensive ways of operation and advocate cheap ways for the contractors and retailers.

And so, in closing, it seems to me we are justified in concluding that the contractors, as individuals, and the "local sales outlets" are actually in revolt and are going to do absolutely nothing of any consequence to feather the nests of the manufacturers, wholesalers and utilities until something is done to provide a fair share of the profits for the retailer and contractor.

The way the manufacturers and wholesalers respond to the invitation of the N.E.C.A. and the support the utilities give the N.E.C.A. will indicate how much value the industry places upon us, and if it really thinks our contact with the consumer important. One thing is certain, the contractors are not going to lean on the government or place too much reliance in others to cause the "big, bad wolves" of the industry to behave. Too many of the "wolves" have shown their colors and we are on to them; furthermore, it is not the nature of wolves to be good.

The contractors are developing an ever stronger national association and are going to build a "stone house that no wolf can blow in." The wolves had better look out, for there is trouble ahead if they do not change their ways.

Possibly Mr. Mayer avoided saying anything about the contractors as a selling force in behalf of the manufacturers and wholesalers by intent. Maybe he knew only too well how the contractor feels.

Please pardon my writing at such length; my excuse is that these articles were so good and I am so interested in the electrical business I could not refrain from expressing myself.

F. E. BOYD.
Vice-President and Manager.

Pacific Electric Motor Company,
Oakland, Calif.

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Contractors Should Not Be By-Passed

To the Editor of the ELECTRICAL WORLD:

Referring to an article by Mr. Welman in the November 18 issue of the ELECTRICAL WORLD, I heartily agree that in some cases the contractor's salvation may lie in his becoming the consumer's adviser in all things electrical (and this is only one of the policies that has been pursued by this company for nigh on to forty years), but permit me to ask you how it is possible to secure salvation even along these lines when in many cases the consumer can buy from the jobber at the same price that the contractor can buy. I will go further, I will not only state that the consumer in many cases can buy from the jobber at the same price as the contractor can buy, but in some instances the jobber will sell the consumer at a lower price than he sells the contractor, and I mean the financially responsible contractor too.

Perhaps if Mr. Welman was thoroughly familiar with all the facts he would not be so sure that the only salvation of the contractor lay in his becoming the consumer's adviser.

L. W. MOXEY, JR.,
President.

Keller-Pike Company,
Philadelphia, Pa.

Men of the Industry

J. Allen Johnson Nominee for A.I.E.E. Presidency

J. Allen Johnson, who was nominated last week for the presidency of the American Institute of Electrical Engineers (ELECTRICAL WORLD, December 16, page 773), has taken a prominent part in the development of the art of power generation and transmission. Per-

haps the most important of such developments was that of the system of generator voltage control by individual regulators, which he originated and pioneered in the plant of the Ontario Power Company about 1910.

Following graduation from the Worcester Polytechnic Institute in 1905, he was employed until 1912 in electrical engineering work by the Ontario Power Company of Niagara Falls, being appointed electrical engineer of that company in 1912. In 1917 this company was purchased by the Hydro-Electric Power Commission of Ontario, of which Mr. Johnson became assistant engineer, but still retained his other position. In 1918 he was appointed electrical engineer of the Cliff Electrical Distributing Company and Hydraulic Power Company of Niagara Falls, N. Y., and with the consolidation of these companies and the old Niagara Falls Power Company to form the Niagara Falls Power Company in 1918 he became electrical engineer of the enlarged company. In this capacity he was responsible for many important features of the electrical design of the Niagara developments during the period of their rapid growth from 1918 to 1924. In 1929 he was appointed chief electrical engineer of the Buffalo, Niagara & Eastern Power Corporation, which position he now holds.

Mr. Johnson has been active in the American Institute of Electrical Engineers for a number of years. He has served as a member of the electrochemistry and electrometallurgy, electrical machinery, instruments and measurements, protective devices, and research committees. At the present time he is a member of the Edison Medal committee and the executive committee and vice-president of the northeastern district. Besides his institute activities Mr. Johnson is at present chairman of the electrical equipment committee of the Edison Electric Institute.

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Dr. Kennelly Recipient of Edison Medal

Dr. Arthur E. Kennelly, who was awarded the Edison Medal for 1933 last week by the American Institute of Electrical Engineers (ELECTRICAL WORLD, December 16, page 773), established an international reputation some years ago for his scientific ability expressed in his continuous contributions to the development of definitions and standards in electrical engineering. A native of Bombay, India, he received his early education in private schools in England, Scotland, France and Belgium and at the University College School in London.

Coming to the United States in 1887, he was engaged as principal electrical assistant to Thomas A. Edison until 1894, when he became associated with Edwin J. Houston in the firm of

Houston & Kennelly, consulting electrical engineers. It was in 1902 that he was appointed professor of electrical engineering at Harvard University and continued in that position until the close of the academic year 1929-1930, when he retired from active service. In addition to his duties at Harvard, he served as professor of electrical engineering at the Massachusetts Institute of Technology 1913-1924, and was for some years director of electrical engineering research there, as well as chairman of the faculty.

Dr. Kennelly is the author of many technical books and of more than 350 papers, many of which were presented before leading technical and scientific organizations in the United States and abroad. He is a fellow, honorary member and past-president of the American Institute of Electrical Engineers, past-president Illuminating Engineering Society, past-president Institute of Radio Engineers, president American Metric Association, honorary member Institution of Electrical Engineers, London, Société Française des Electriciens, Verband Deutscher Elektrotechniker E. V. and of the Institute of Electrical Engineers of Japan and a member of the National Academy of Sciences, American Association for the Advancement of Science and of many other societies. He is a representative of the institute on the U. S. National Committee of the International Commission on Illumination, and is honorary secretary of the U. S. National Committee on the International Electrotechnical Commission.

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OBITUARY

ARTHUR A. BROWN, assistant to the vice-president of the Westinghouse Electric & Manufacturing Company, died December 19 at his home in Mount Vernon, N. Y., of a sudden heart attack. For more than thirty years Mr. Brown was identified with the electrical manufacturing industry. A native of Arkansas, he received his technical education at the University of Illinois and made his first business connection with the Bethlehem Steel Company in 1900. It was in 1904 that he became identified with the Westinghouse Machine Company, later joining the sales staff of Westinghouse, Church & Kerr. He became associated with Westinghouse Electric subsequently as a salesman in the New York office. He soon was made manager of syndicate operations and finally promoted to assistant to the vice-president.

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HERBERT T. HERR, for many years a vice-president of the Westinghouse Electric & Manufacturing Company, died December 19 at his home in Philadelphia after a short illness. Mr. Herr was internationally known as an inventor and designer of turbines, oil and gas engines and of various ingenious air brake devices. A native of Denver, Colo., and a graduate of the Sheffield Scientific School of Yale University, he spent several years in the railroad field before becoming general manager of the Westinghouse Machine Company in 1908. Five years later he was appointed

first vice-president and general manager, and when the Machine Company was merged in 1917 with the Westinghouse Electric & Manufacturing Company he became vice-president of the latter, in which position he continued up to the time of his death. Mr. Herr was a member of the American Institute of Mining Engineers, the American Society of Mechanical Engineers and of other technical societies. In 1914 he was awarded the Edward Longstreth medal by the Franklin Institute of Philadelphia and the diploma of merit for his exhaustive paper on steam turbines.

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THOMAS LEIGH, general counsel for the Gould Electric Company and the Maine & New Brunswick Electric Power Company, died at Augusta, Me., December 13 after a two weeks' illness. He was a native of Hallowell, Me., was educated at Dartmouth College and was in his seventy-second year.

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GEORGE F. AVIS, organizer of the Southern Michigan Light & Power Company, which supplied the first electric service in Hudson 45 years ago, died in that city early in December at the age of 73. He was president until he sold his interest to the Consumers Power Company in 1926.

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JOSEPH H. WALCOTT, plant engineer of the Seth Thomas Clock Company, Thomaston, Conn., for the past five years, died at his home in that city December 13. He was born at Danvers, Mass., 44 years ago and for seven years was plant engineer at the factory of the Helburn-Thompson Company, Salem, Mass.

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FRANK M. COLDRICK, electrical contractor of Medford, Mass., died at his home in that city December 13 at the age of 43. He was a graduate of the Tufts College Engineering School and was well known in electrical circles north of Boston.

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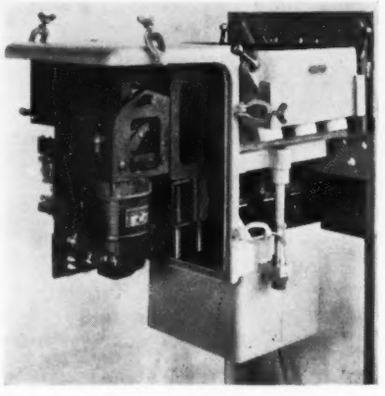
JOHN C. STILES, connected with the U. S. Corps of Engineers, died recently at St. Louis, Mo., in his forty-eighth year. At the time of his death he was engaged on electric power studies and Federal Power Commission work in the Upper Mississippi Valley division office. His technical training was received at the Georgia School of Technology and his early practical experience in Cuba on electric railway construction and in the southern part of the United States. He was employed by the War Department at Wilson Dam, Florence, Ala.; also at Cincinnati, Ohio, and at St. Louis, Mo. During this connection Mr. Stiles wrote several articles on electric power work which were published in the ELECTRICAL WORLD.

New Equipment Available

High-Space Motor Operator

High-speed motor operator for application to small switchboard type oil circuit breakers and to subway and pole line oil switches has been announced by the



Condit Electrical Manufacturing Corporation, Boston, Mass. The operator, designated as type UC-30, consists of a universal motor directly connected through a trip-free mechanism to the oil circuit breaker. So fast is the operator that closure can be accomplished in approximately 8 cycles, it is claimed.

The motor is suitable for operation on 110 or 220 volts a.c., 25 or 60 cycles, and 48, 125 and 250 volts, d.c. It is especially suitable for automatic throwover and automatic reclosing service.

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ADDITIONS TO ITS LINE of conduit fittings, pull or junction boxes designed to facilitate the installation of heavy wires in large conduits or long runs to make splices on large size wires have been announced by the Killark Electric Manufacturing Company, St. Louis, Mo.

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AUTOMATIC FIRE ALARM UNITS of the appliance type for use in the home and which can readily be installed in the various spots around a residence by simply screwing the unit into an electric socket have been announced by the Gamewell Company, Newton, Mass. Fire can be detected instantaneously regardless of the existing temperature, the manufacturer claims.

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IMPROVED FLEXIBLE COUPLING known as "Morflex," using an unusual and specially developed rubber as the flexing medium, has been announced by the Morse Chain Company, Detroit. The flexing member is a complete unit comprising four molded non-cold-flow rubber trunnion blocks of special design spaced 90 deg. apart and set, under pressure, into a two-piece riveted steel housing. The rubber trunnion blocks are provided with steel cores or bushings also set under pressure into the blocks.

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AN INSTRUMENT FOR TESTING the dielectric strength of various types of sheet materials such as paper, gummed paper, cloth varnished cambric and paper, etc., has been announced by the Sound Engineering Corporation, Chicago. Known as the model 1-IE, the determination of the dielectric strength of an insulating material requires that a sample be placed in an electrical field of sufficient intensity to disrupt or break down the molecular structure of the material under test.

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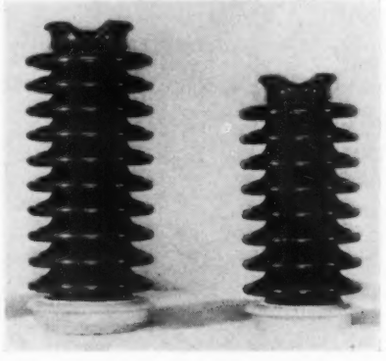
Line Post and Station Post Insulators

Line post and station post insulators consisting of hollow, closed-end porcelain posts which are cemented into malleable iron or forged steel bases, have been announced by the Lapp Insulator Company, Inc., LeRoy, N. Y. The line post units are equipped with standard tie heads for the attachment of the conductor with tie wires in the usual manner. The base is mounted directly



on the crossarm and held in place by a steel stud extending through the crossarm in the same way as a standard insulator pin. Station post insulators are equipped with caps at both ends. These caps carry the conventional 3- or 5-in. bolt circle for use in mounting the insulator and for attaching apparatus as in the usual outdoor substation.